Dräger medical
A Dräger and Siemens Company

Dräger Vapor® 2000

Anaesthetic Vaporiser
Instructions for Use

Intended Use

Dräger Vapor® 2000 is an unheated, calibrated anaesthetic vaporiser for the enrichment of dry, fresh medical gas in anaesthesia delivery systems with accurately-controlled concentrations of vapour from liquid anaesthetic agents. The concentration delivered is, for the most part, not influenced by operating and ambient conditions, such as temperature, gas flow and ventilation pressure.

The Vapor 2000 is suitable for use in strong magnetic fields (MRI equipment) when used in accordance with the operating instructions on page 24.

Each Vapor is calibrated for a specified anaesthetic agent and is only suitable for that anaesthetic agent.
Different models of Vapor are specified for different anaesthetic agents and are marked accordingly.

The Vapor is inserted in the fresh-gas line of the anaesthesia delivery system which typically delivers a continuous fresh-gas flow. The Vapor is connected between the fresh-gas flow-control unit and the fresh-gas outlet.
The Vapor is not suitable for use with a breathing system due to high pneumatic resistance.

Proper functioning of the Vapor is dependent on the direction of flow. It must be connected and operated in accordance with the direction of flow specified on the machine.
The use of the Vapor with different anaesthesia delivery systems is, therefore, only permissible and safe when it is used with the appropriate special adapters.
Simultaneous operation of several Vapors switched in series is not permissible, particularly for different anaesthetic agents.

Dräger recommend that the output concentration is monitored to detect any hazardous output values, using a monitor which has continuous measurement and upper and lower alarm limits.

Installation and/or operation with anaesthesia delivery systems in mobile vehicles, aeroplanes, helicopters and ships is only permissible after consultation with Dräger and their agreement.

The Vapor must only be used by qualified medical personnel to ensure that any malfunction can be remedied without delay.

According to US and Canadian law these machines must only be used by or on the instructions of a fully qualified medical practitioner.

Registered trademarks

– Dräger Vapor®
– Dräger Fill®
are Dräger registered trademarks.

– Quik Fil®
is a registered trademark of Abbott Laboratories.

– Selectatec®
is a registered trademark of Datex-Ohmeda.

Method of Operation

Handle Vapor with care.
Be careful not to tilt or drop.
Do not carry by the control dial, control dial caps or locking lever for the plug-in adapter.
Risk of injury.
Do not use Vapor if it has been dropped.
Damage may result in incorrect output concentration.

Control dial

For switching on and off and adjusting the concentration of anaesthetic agent. In the »0« setting and in the »T« transport setting, the control dial is locked but it can be freed by pressing »0« button.

All illustrations of a Vapor on an anaesthesia delivery system show a stylised anaesthesia delivery system in the background. All illustrations of the transport setting show only the disconnected Vapor by itself.

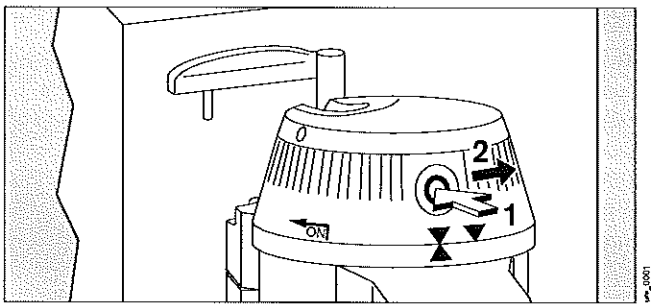
»ON« – Switching on and adjusting concentration:

Only adjust concentration when the Vapor is connected to an anaesthesia delivery system.

1 **Press** »0« button and

2 turn control dial anti-clockwise to required concentration of anaesthetic agent.

Concentration values greater than 5 vol.% are shown in inverted form in order to draw attention to the danger of a high output concentration and restricted flow range.

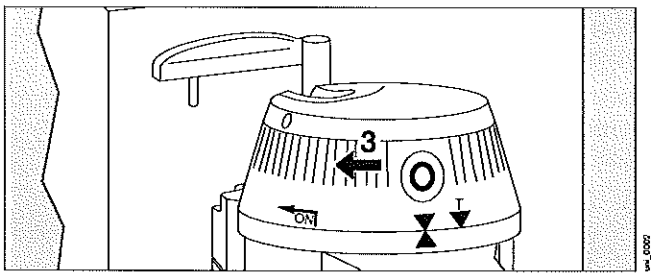


»0« – switching off:

When Vapor is connected to an anaesthesia delivery system only set to »0« when anaesthetic agent is not being administered.

3 Turn control dial clockwise to »0« – »0« button engages.

When control dial is set at »0« or above »0«, do not use Vapor at an angle of more than 30°.
Risk of incorrect output concentration or anaesthetic agent escaping otherwise.



»T« – Transport:

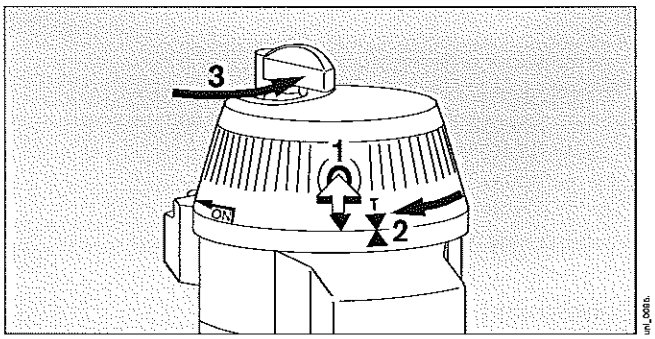
Only set to **»T«** when Vapor is being disconnected from the anaesthesia delivery system or is connected to the parking holder.

1 **Press »0«** button and

2 turn control dial clockwise to **»T«** transport setting – **»0«** button engages.

3 For plug-in adapter: engage locking lever in control dial.

At »T« setting Vapor may be moved in any position. If not at »T« setting, risk of incorrect output concentration, or of anaesthetic agent escaping otherwise.



Connecting and Interlock systems

When the Vapor is used with different anaesthesia delivery systems, different connecting systems have to be used. When anaesthesia delivery systems have several Vapor connectors, the different Interlock systems[1] ensure that only one Vapor can be used at any one time, while the others are switched off and blocked.

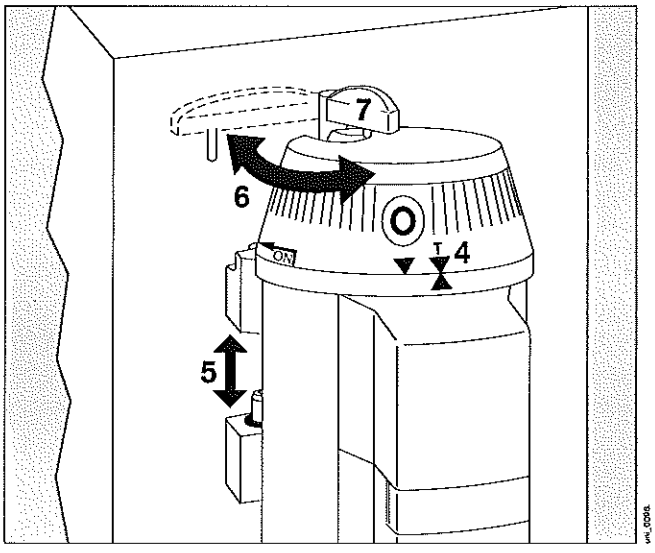
The interlock system on the vaporiser and anaesthesia delivery system must be functional. Especially with **Interlock 2, the nibs must be engaged and undamaged in both openings of the interlock disc.** See also "Checking Readiness for Operation" Page 36.

A malfunctioning Interlock may endanger the patient by causing overdosing or a mixture of anaesthetic agents.

Plug-in adapter/plug-in connector

to connect Vapor safely and change over quickly. Most plug-in connectors have valves to allow fresh gas to flow through, whether the Vapor is, or is not, connected. These plug-in connectors can be identified by the moveable valve inserts in the inner holes on the connector pins.

Many Vapors with plug-in adapters carry an anaesthetic agent code on the back, which can be read and displayed by anaesthesia delivery systems designed for the purpose.



4 To connect/disconnect, control dial must be at the **»T«** setting and the locking lever must be engaged in the control dial.

5 The holes in the plug-in adapter on the Vapor fit onto the pins on the plug-in connector on the anaesthesia delivery system.

6 To secure/release, swing locking lever into position and engage/disengage the pin in the cover plate on the Vapor.

7 The locking lever and pin help to ensure that the Vapor is handled correctly and that it can only be fitted and disconnected when the control dial is at the **»T«** setting.

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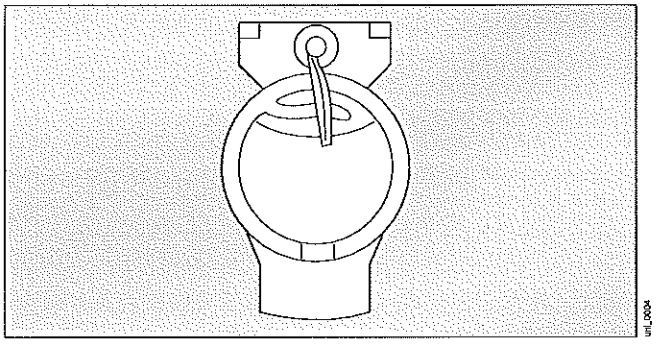
1 The different Interlock systems are not compatible with each other. However, the Vapor can be modified from one system to another.

Plug-in DW-2000 adapter with Interlock 2

For connecting to Dräger plug-in connectors.

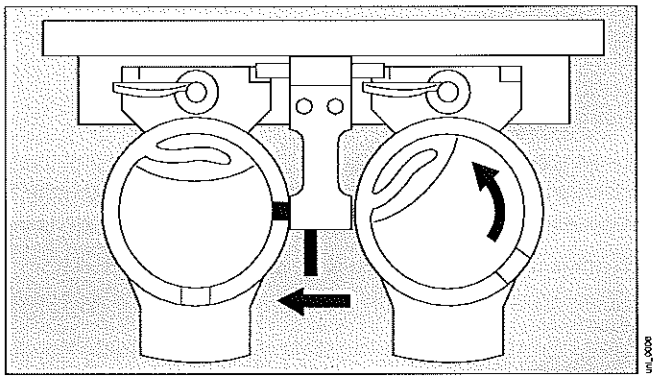
DW-2000 is not compatible with the Dräger Auto Exclusion System.



For anaesthesia delivery systems with two plug-in connectors combined with **Interlock 2.**

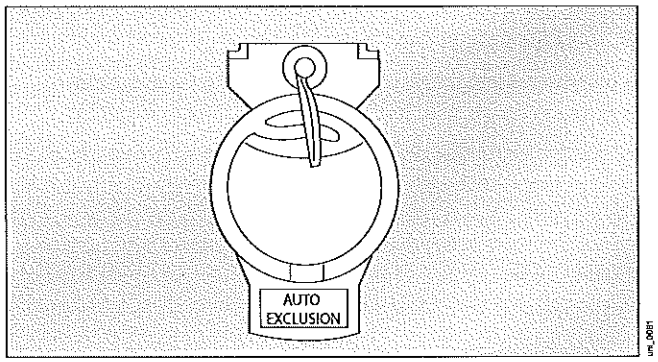
The locking bar, which can only be engaged in the control dial when at »0« setting, allows only one Vapor to be in use at any one time.

Illustration: left Vapor blocked, right Vapor operational.



Dräger Auto Exclusion plug-in adapter

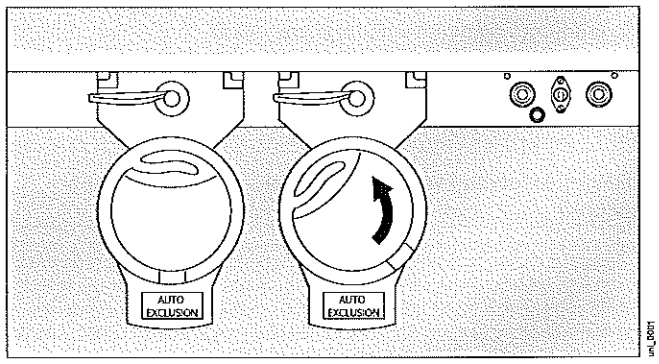
for connecting to Dräger Auto Exclusion plug-in connectors and Dräger plug-in connectors.



For anaesthesia delivery systems with Auto Exclusion plug-in connectors.

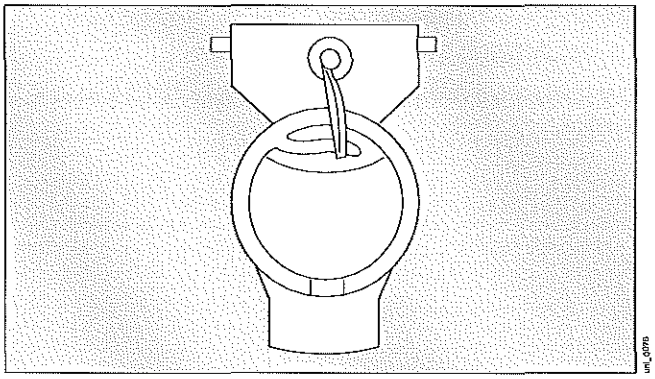
When a Vapor is switched on, a pin on the underside of the plug-in adapter is pushed out. This prevent other Vapors on adjacent plug-in connectors being switched on via an internal mechanism.

Illustration: left Vapor blocked, right Vapor operational.



Plug-in S-2000 adapter with Interlock S

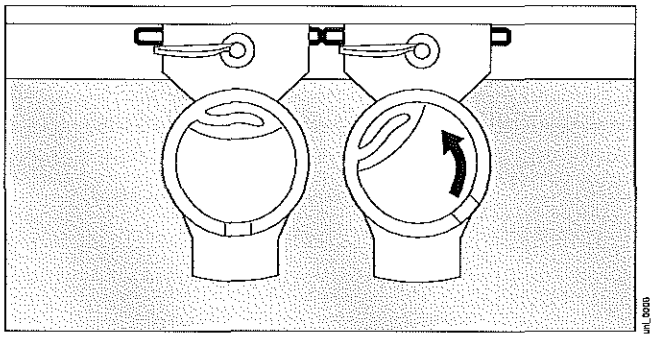
For connecting to Selectatec-compatible plug-in connectors.



For anaesthesia delivery systems with several plug-in connectors combined with **Interlock S.**

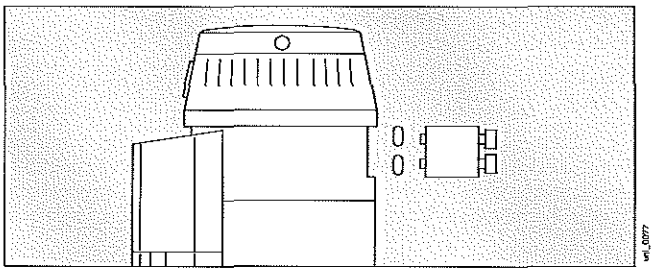
When a vaporiser is switched on, two pins on the side of the relevant plug-in adapter are pushed out. These prevent other vaporisers on adjacent plug-in connectors being switched on.

Illustration: left vaporiser blocked, right Vapor operational.



Permanent connection

a permanent installation in fresh-gas line for anaesthesia delivery systems, with the appropriate connector options.

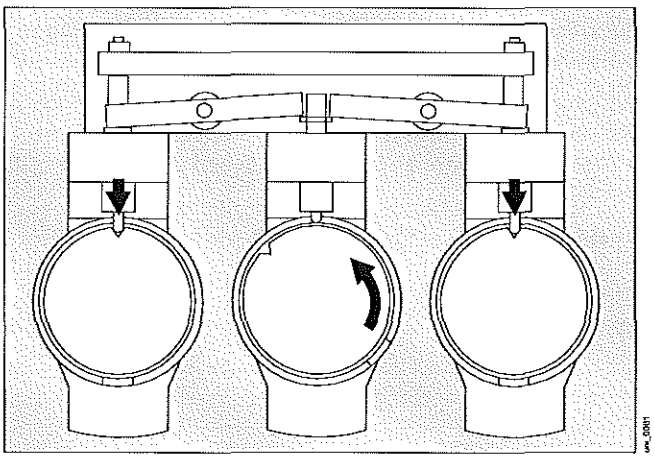


For anaesthesia delivery systems with several plug-in connectors combined with **Interlock NMD.**

When a Vapor is switched on, a lever is activated which prevents other Vapors on adjacent connectors being switched on.

Illustration: central Vapor operational, right and left Vapor blocked.

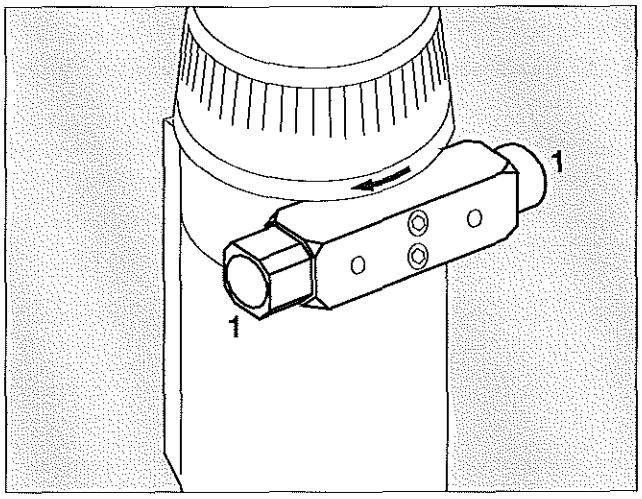
Other Interlock systems are also used, such as Interlock 1, which are very similar to Interlock NMD, but which need not fit a Vapor with Interlock NMD.



Conical connector, 23 mm

for anaesthesia delivery systems with 23 mm conical connectors conforming to ISO 5356-1 on the fresh-gas line.

1 Conical connector on Vapor.



Filling systems

For filling Vapor with the specified anaesthetic agent and draining.

With a display of filling level with minimum and maximum levels marked and a third (middle) mark which shows when a whole bottle (250 mL) can be used.

Dräger recommend the use of anaesthetic-agent-specific filling systems to prevent incorrect filling and to reduce the volume of anaesthetic agent vapour released during the filling process.

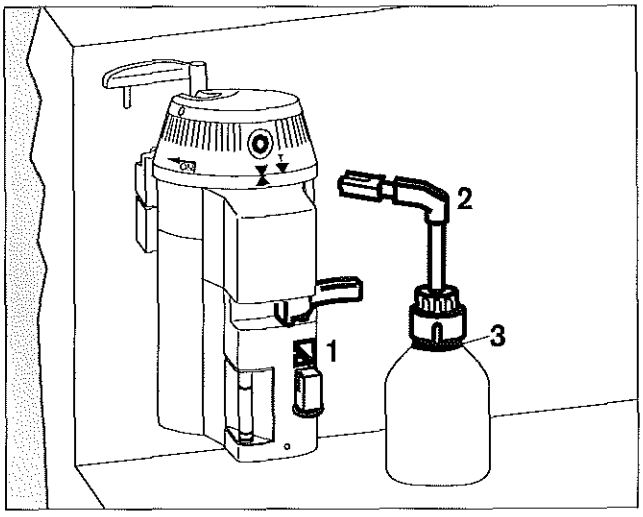
Keyed filling system

consisting of

1 the anaesthetic-agent-specific filling system on Vapor

2 an anaesthetic-agent-specific filling adapter

3 the anaesthetic-agent specific collar and threads on the neck of the bottle.

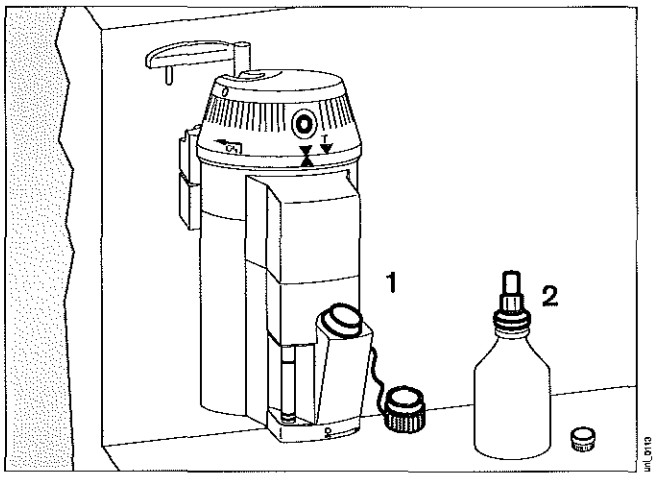


Dräger Fill filling system

consisting of

1 the anaesthetic-agent-specific filling system on the Vapor,

2 the anaesthetic-agent-specific Dräger filling adapter on the bottle.



Quik Fil filling system

consisting of

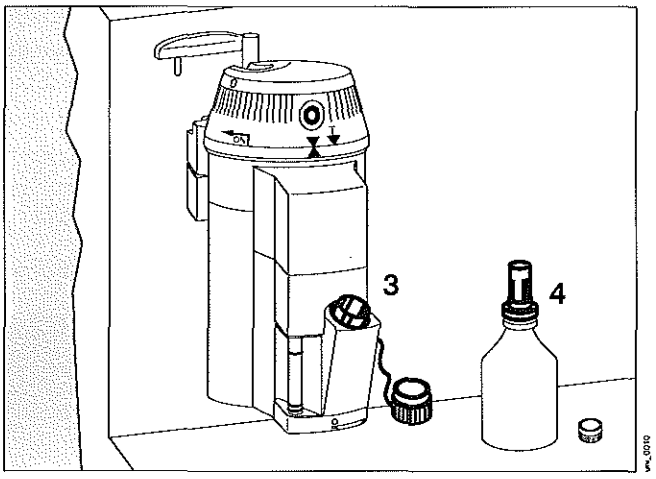
3 the anaesthetic-agent-specific filling system on the Vapor

4 the anaesthetic-agent-specific adapter firmly mounted on the bottle.

Quik Fil filling system with screw-on adapter (not shown)

consisting of

- the anaesthetic-agent-specific filling system on the Vapor,
- the anaesthetic-agent-specific Quik Fil filling adapter on the bottle.

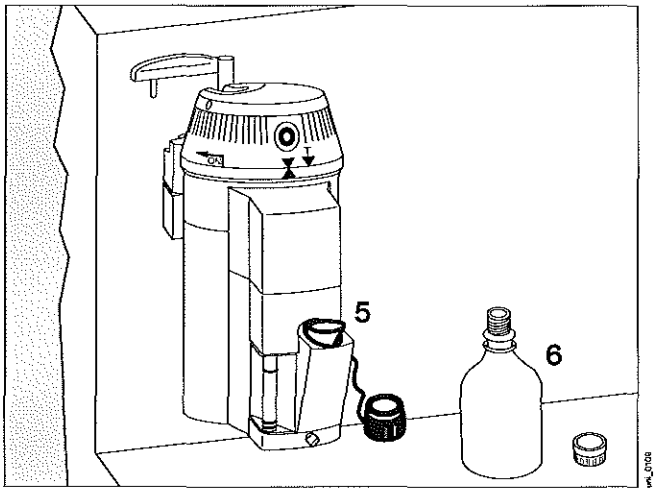


Vapor with filling spout

consisting of

5 a **non-specific** filling system on the Vapor

6 the anaesthetic agent bottle.

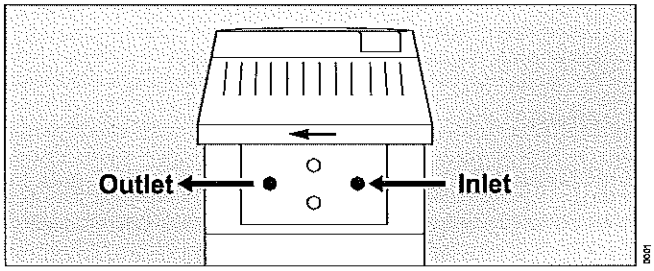


Preparation

Fitting connectors

Use only authentic Dräger parts.
Only selected materials may be used with anaesthetic agents in breathing gas.
Connectors may only be fitted by trained service personnel, because they must be dismantled and checked.
Risk of incorrect output concentration or escape of anaesthetic agent otherwise.

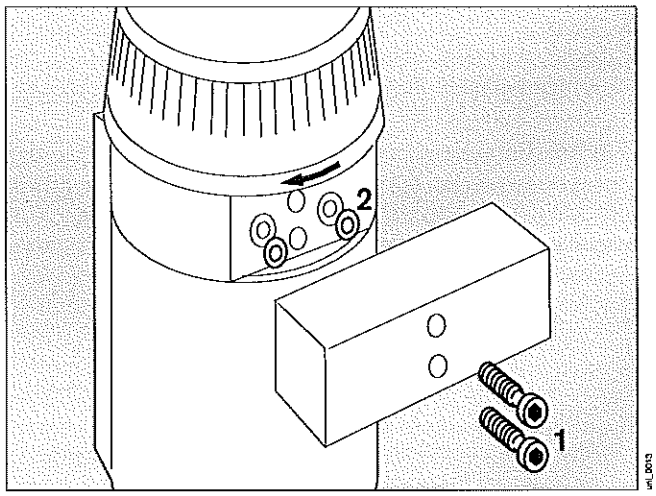
- Remove protecting cap on gas inlet/gas outlet at the back – when fitted.
- Always connect Vapor in such a way that the gas flow matches the illustration given and the arrow on the back.



If the flow is in the wrong direction an incorrect concentration may be delivered, often an increased concentration.

- Follow Instructions for Use for Anaesthesia Delivery System.
- For conical connectors: the male cone on the connecting piece is the Vapor inlet; the female cone on the connecting piece is the Vapor outlet.

1 Two new screws – do not re-use old screws:
   - strength class 10.9, surface A2R conforming to DIN ISO 4042, heat treated.
   - dimensions DIN EN ISO 4762-M4 x length depending on connector.
     Screws fitted through the connector must be screwed into place with a thread length of not less than 5 mm and not more than 7 mm.
     If screws less than 25 mm long are used, additional centering pins must be fitted.



- Do not use fan locking washers, washers or similar.

If these requirements are not met, the Vapor might fall off. Risk of injury.
Risk of incorrect output concentration.

- Before fitting, check that the connecting surfaces, particularly the sealing areas, are clean and undamaged.

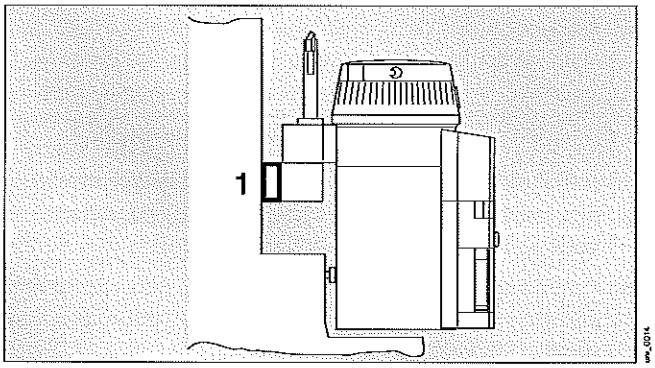
2 Place 2 sealing rings, item no. M 21929, on the sealing areas around the gas passages.

- Tighten screws to 270 to 300 Ncm once, do not tighten once more.
- Check that the connector is secure.

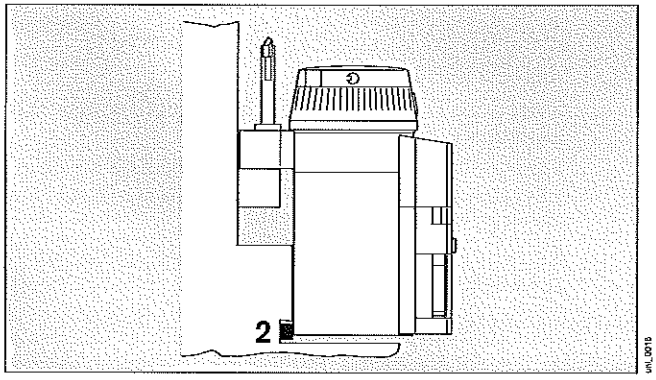
Before using for the first time

- Check that Vapor is undamaged.
- Set control dial to »T«.
- Remove locking device from gas inlet/gas outlet on the back of the Vapor – if fitted.
- "Check readiness for operation", see page 36.
- If Vapor is to be connected to type SA2 or Titus anaesthesia delivery systems:
  these machines must be modified for operation with the Vapor 2000 (DrägerService) before the connection is made.

1 SA2:
detail of modification:
extra plate, 1 cm thick, between plug-in connector and housing of anaesthesia delivery system.



2 Titus:
detail of modification:
rubber buffer of O_2 alarm, fitted at the point where Vapor is hanging, fits flush with surface of housing.



Check that the Vapor fits flush with the lower installation points and, when viewed from the side, is suspended from the machine in a vertical position.

Risk that fresh gas and anaesthetic agent vapour may escape otherwise.

- "Filling Vapor", see page 13.
  After filling for the first time wait 15 minutes for the dry wicks inside to become saturated.
  The filling level of the anaesthetic agent may drop; refill if required.
- "Checking concentration", see page 39.
- Use on anaesthesia delivery systems made by other manufacturers only after a system function check for geometry, pressure and flow has been carried out by trained service personnel (on each type of anaesthesia delivery system).

The technical data for Vapor 2000 and the anaesthesia delivery system must be adhered to. Any deviations might result in incorrect concentrations being delivered.

Filling Vapor

Take care not to spill anaesthetic agent.
Do not inhale anaesthetic agent vapour.
Danger to health.

Recommendation: ensure adequate ventilation when filling Vapor when not connected to anaesthesia delivery system.

Only fill Vapor with the anaesthetic agent specified on it.[1]
Observe use-by date for anaesthetic agent.
When using branded products from different manufacturers make sure that the correct agent is used, for instance, following the colour coding of the Vapor and the anaesthetic agent bottle:

Halothane	red
Enflurane	orange
Isoflurane	purple
Sevoflurane	yellow

From a **technical viewpoint** the same anaesthetic agent from different manufacturers with different tradenames, which are identical in composition and physical and chemical properties and are approved as medicaments, can be administered separately or in combination in Vapor and monitored with Dräger anaesthetic agent monitors.

Do not use a Vapor which has been filled or partly filled with the wrong anaesthetic agent or other substances.

The concentration delivered may be significantly higher or lower than the concentration set on the control dial.

Risk of explosion from combustible substances.

Many anaesthetic-agent monitors do not identify mixtures of anaesthetic agents and/or detect that the anaesthetic agent being measured differs from the agent that was set. Unusual deviations in the concentration displayed on a monitor may indicate incorrect filling.

If this has happened, mark Vapor for appropriate substance and call DrägerService for repair.

Make sure that the drainage valve is closed as significant quantities of anaesthetic agent may escape if it is not.

Keep Vapor upright, or hanging vertical, while it is being filled.

If it is at an angle it can be overfilled which may lead to concentrations which are too high or too low.

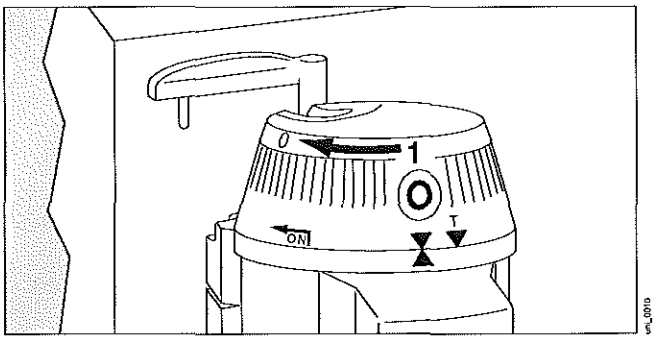
1 Only use anaesthetic agents approved in the country of use.

Vapor with keyed filling system

Note warnings on page 13.

If Vapor is connected to anaesthesia delivery system:

control dial remains engaged at »0«.



When filling during operation:

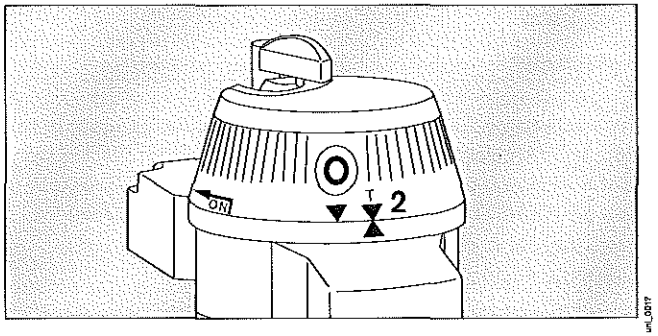
- Fresh-gas flow can remain as set.

1 Set control dial to »0«

Wait for 5 seconds for pressure to equalise, as fresh gas and anaesthetic agent vapour may escape otherwise.

If Vapor is not connected to anaesthesia delivery system:

2 Control dial remains engaged at »T«.



3 Only use anaesthetic agent bottle with anaesthetic-agent-specific collar on neck of bottle.

Substance-specific filling cannot be assured if bottles without a collar are used.

- Select filling adapter for relevant anaesthetic agent – colour coding and designation/symbols on the filling adapter must correspond to the anaesthetic agent used.

4 Recommendation: only use filling adapter with check valve.

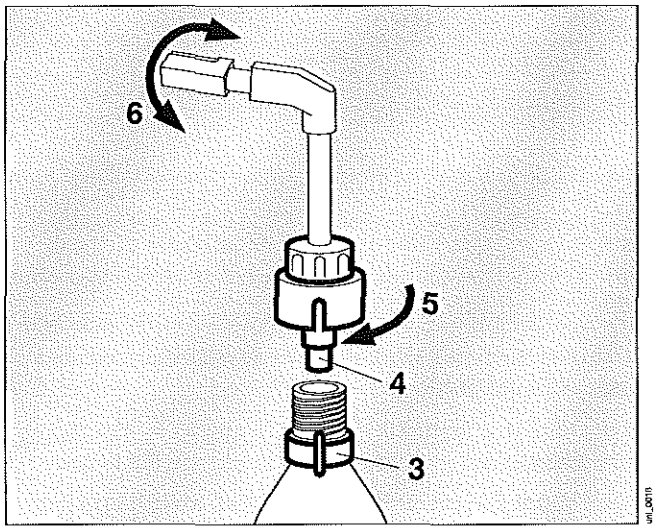
- Do not use filling adapters or bottles which are damaged.

If new, sealed bottles are partly empty there may be a leak.

5 Screw filling adapter **firmly** into anaesthetic agent bottle.

If connection between filling adapter and anaesthetic agent bottle is not leak-tight, Vapor can overfill and anaesthetic agent vapour escape. Danger to health.

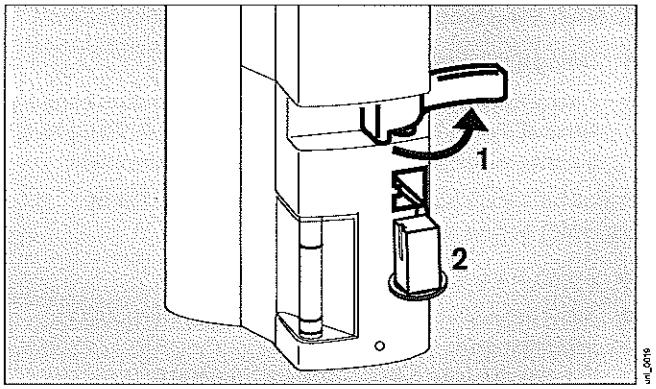
6 Rotate square section on filling adapter so that holes are on the underside.



1 Swing lever **slowly** so that pressure in Vapor can escape slowly.

2 Pull sealing block out completely and fold down.

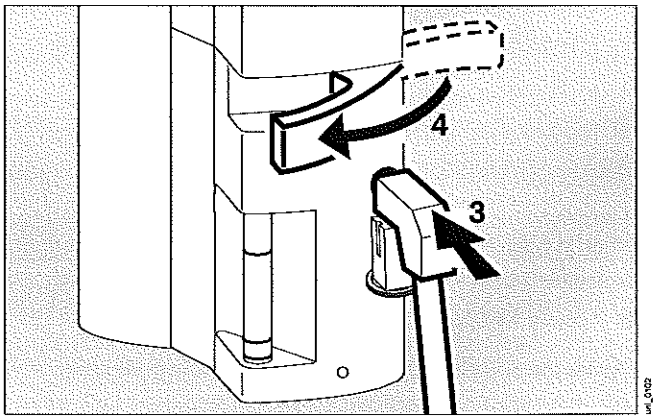
- Hold anaesthetic agent bottle below Vapor.
  The holes on the adapter must be on the underside.



3 Push filling adapter into the opening of the filling system until it engages.

4 Tighten lever – do not use excessive force.
The lever need **not** be flush with the front of the machine.

Excessive force may damage the seal and fresh gas and anaesthetic agent vapour may escape.
Danger to health.

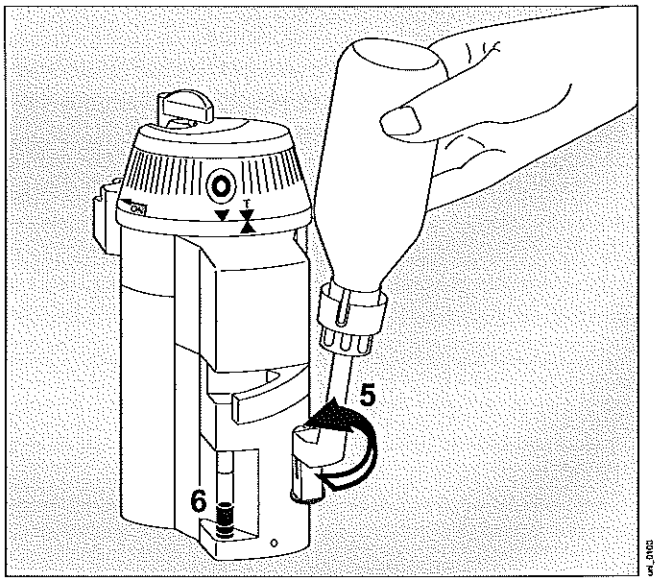


5 Swing anaesthetic agent bottle upside down **slowly** and **hold** in this position.

A bottle which is dropped may release significant quantities of anaesthetic agent.

6 Watch filling level on sight glass.
When maximum mark is reached, flow stops automatically.

If, however, the filling adapter has not been connected to the anaesthetic agent bottle or to Vapor sufficiently securely or tightly anaesthetic agent may continue to flow into the Vapor*.



Fill to maximum mark only.
If the Vapor is filled above the maximum mark by a few millimetres, the anaesthetic agent will start to overflow through an overflow hole.

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* Seals on Vapor and filling adapter are parts subject to wear; check and replace, when necessary.

To finish filling process:

1 Swing anaesthetic agent bottle down.

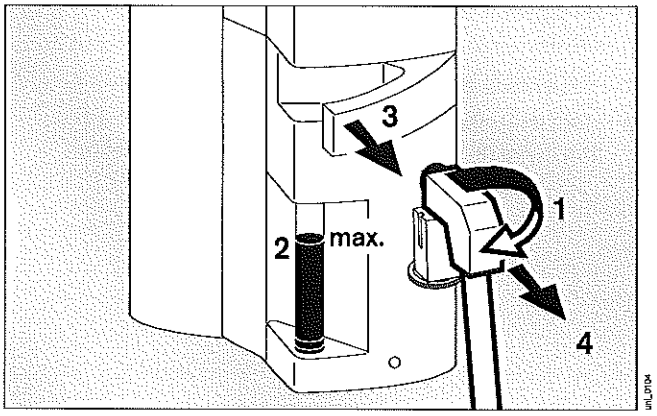
2 Check filling level on sight glass – Vapor must be hanging **vertical** during this check or standing upright. Filling level must be visible and must not exceed maximum mark.

If maximum mark has been exceeded there is a **risk of incorrect output concentration**, so

- Swing anaesthetic agent bottle down.
- Allow anaesthetic agent to flow back into the bottle to maximum mark.
  If necessary, see "Draining Vapor", page 41.

3 Swing lever up.

4 Pull filling adapter out.



5 Insert sealing block, push in **fully** and **keep pushed in.**

6 Lock lever.

If this is not done properly, fresh gas and anaesthetic agent vapour may escape.

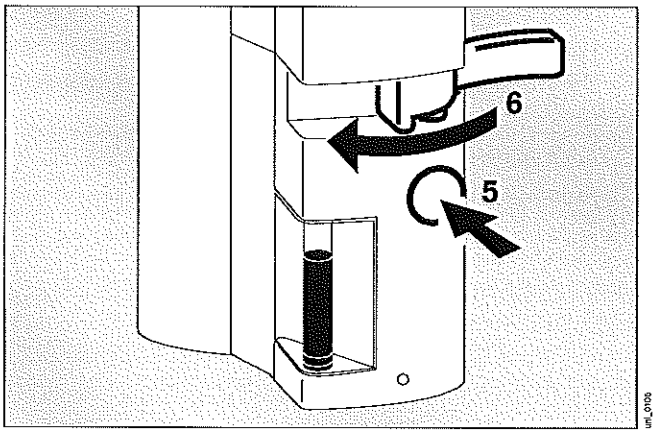
If lever cannot be fully closed, release lever and push sealing block in **fully.** If this is not done, sealing block is not leak-tight, and seal may be damaged.

- Unscrew filling adapter.

Anaesthetic agent bottle must not be stored with the filling adapter screwed on. Anaesthetic agent will escape.

- Close bottle even if it is completely empty, or allow residues of anaesthetic agent in the filling adapter and on the anaesthetic agent bottle to evaporate under an extractor fan.

If this is not done properly, anaesthetic agent vapour will escape into the ambient atmosphere.

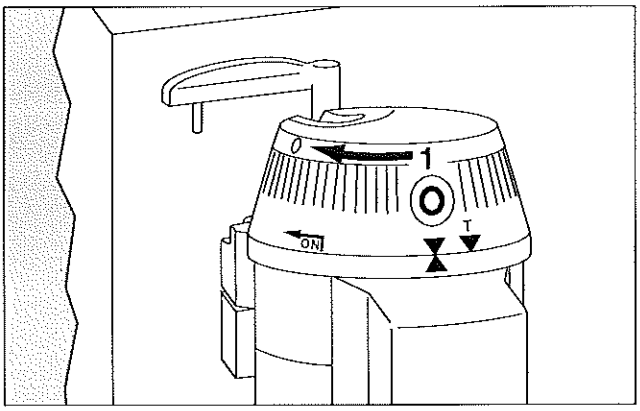


Vapor with Dräger Fill filling system

Note warnings on page 13.

If Vapor is connected to anaesthesia delivery system:

control dial remains engaged at »0«.



Filling during operation:

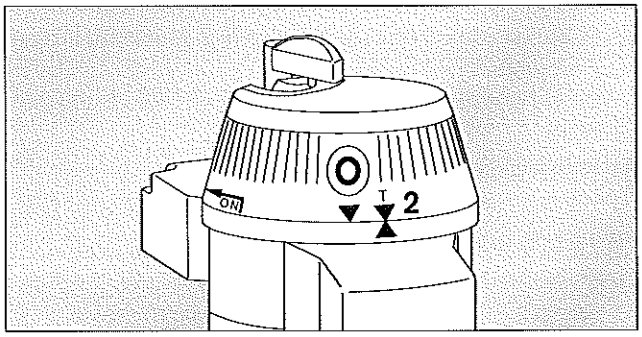
- Fresh-gas flow can remain as set.

1 Set control dial to »0«.

Wait for 5 seconds for pressure to equalise, as fresh gas and anaesthetic agent vapour may escape otherwise.

If Vapor is not connected to anaesthesia delivery system:

2 control dial remains engaged at »T«.



3 Only use anaesthetic agent bottle with anaesthetic-agent-specific collar on neck of bottle.

Substance-specific filling cannot be assured if bottles without a collar are used.

- Select Dräger Fill filling adapter for relevant anaesthetic agent – colour coding and designation/symbols on the filling adapter must correspond to the anaesthetic agent used.

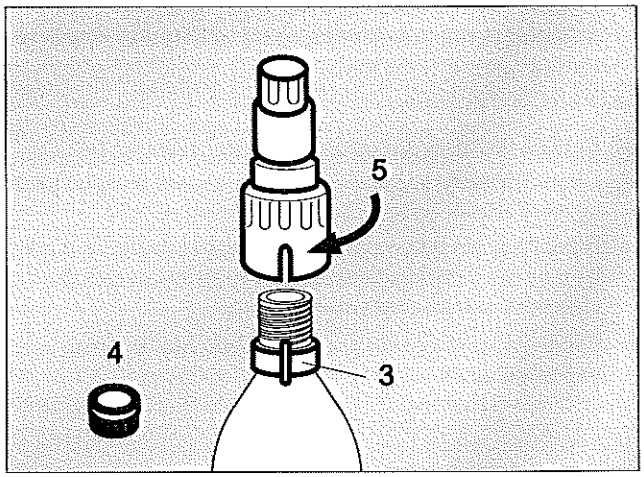
4 Remove screw cap from bottle.

- Do not use filling adapters or bottles which are damaged.

If new, sealed bottles are partly empty there may be a leak.

5 Screw Dräger Fill filling adapter **firmly** onto anaesthetic agent bottle.

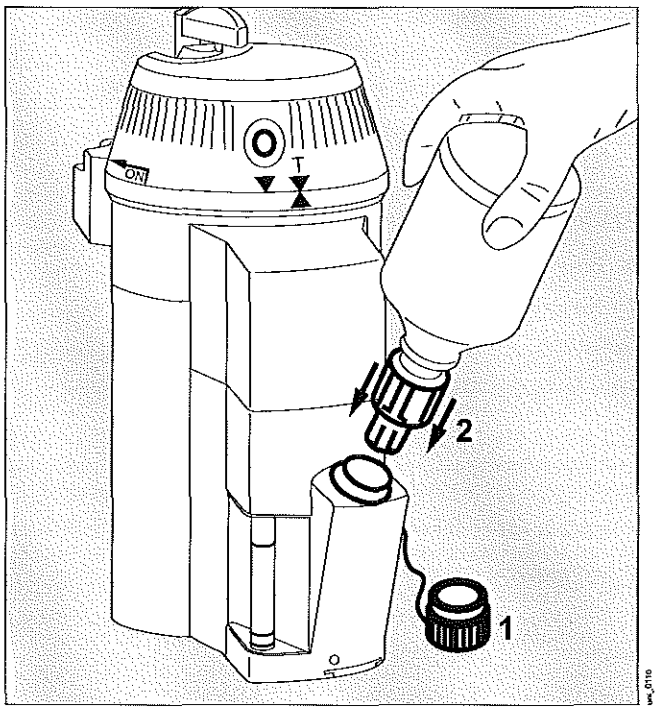
If connection between filling adapter and anaesthetic agent bottle is not leak-tight, Vapor can overfill and anaesthetic agent vapour escape. Danger to health.



1 Unscrew locking cap on filling system **slowly** so that any pressure in Vapor can escape slowly.

2 Insert bottle with filling adapter into filling opening. Turn the bottle **clockwise** until the coded area of the filling opening has engaged.

Do not turn the bottle anticlockwise. The filling adapter could detach from the bottle.



3 Press the bottle to the stop in the filling opening and keep it pressed.

Do not use excessive force and be careful not to twist the bottle.

4 Note filling level on sight glass.

When maximum mark is reached, flow stops automatically.

Fill Vapor to maximum mark only.

If, however, the filling adapter has not been connected to anaesthetic agent bottle securely and tightly enough, anaesthetic agent may continue to flow into Vapor.

5 **If Vapor is filled above the maximum mark by a few millimetres the anaesthetic agent will start to overflow through an overflow hole.**

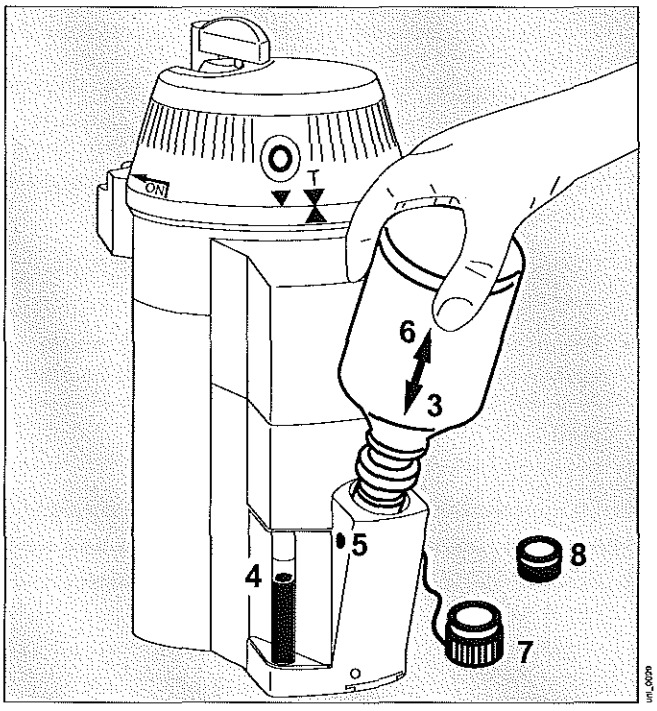
To finish filling process:

6 Reduce the pressure on bottle and pull bottle out slowly.

4 Check the filling level on sight glass – Vapor must be hanging **vertical** during this check or standing upright.

Filling level must be visible and not above maximum mark. If maximum mark has been exceeded there is a **risk of incorrect output concentration**, so:

- Empty Vapor at least to maximum mark, see "Draining Vapor" page 41.



7 Tighten screw cap firmly.

If this is not done properly fresh gas and anaesthetic agent may escape when Vapor is next switched on.

- Unscrew Dräger Fill filling adapter from the bottle and

8 close bottle with the screw cap.

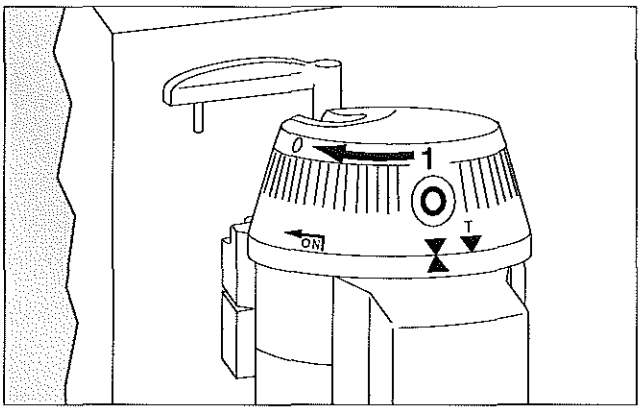
Do not store bottle with Dräger Fill filling adapter screwed on.

Vapor with Quik Fil filling system

Note warnings on page 13.

If Vapor is connected to anaesthesia delivery system:

control dial remains engaged at »0«.



When filling during operation:

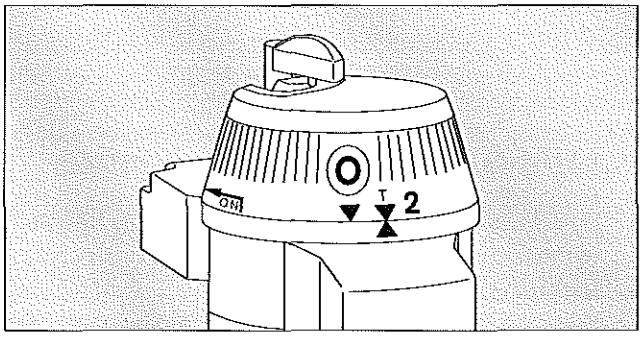
- Fresh-gas flow can remain as set.

1 Set control dial to »0«

Wait for 5 seconds for pressure to equalise, as fresh gas and anaesthetic agent vapour may escape otherwise.

If Vapor is not connected to anaesthesia delivery system:

2 Control dial remains engaged at »T«.

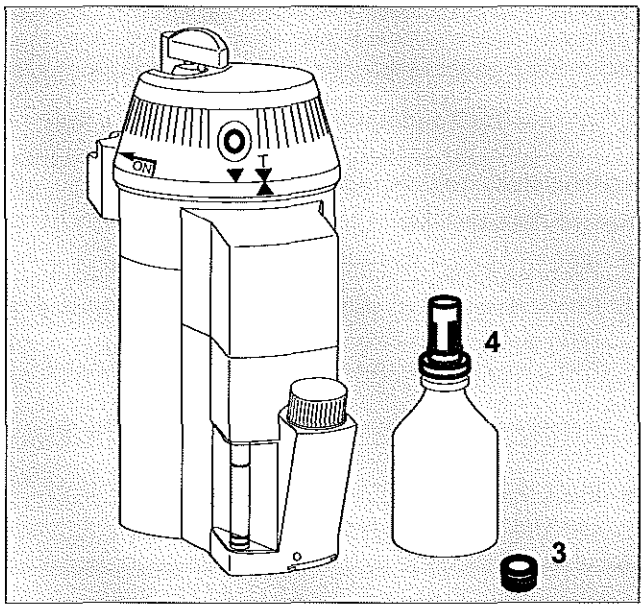


3 Unscrew cap from bottle adapter.

4 Bottle adapter must rest **securely** and **tightly** on bottle and must not be damaged.

If new, sealed bottles are partly empty, there may be a leak.

If connection between filling adapter and anaesthetic agent bottle is not leak-tight, Vapor can overfill and anaesthetic agent vapour escape. Danger to health.



For Quik Fil filling system with screw-on filling adapter:

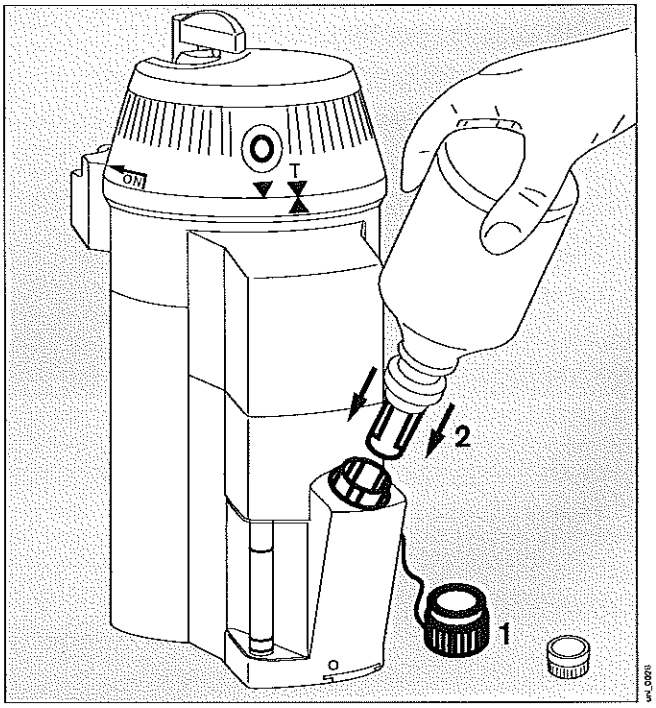
- Remove screw cap from bottle and screw Quik Fil filling adapter **firmly** onto the anaesthetic agent bottle. See "Vapor with Dräger Fill filling system" Page 17.

Only use anaesthetic agent bottle with anaesthetic-agent-specific collar on neck of bottle.

Substance-specific filling cannot be assured if bottles without a collar are used.

1 Unscrew locking cap on filling system **slowly** so that any pressure in Vapor can escape slowly.

2 Insert bottle with the flanges going into the matching slots on the filling connector.
Only use bottles with correct flanges.
Take care over colour coding on bottle and Vapor.



3 Push bottle into filling connector to the stop and keep pushed in.
Do not use excessive force and be careful not to twist the bottle.

4 Note filling level on sight glass.
When maximum mark is reached, flow stops automatically.

Fill Vapor to maximum mark only.

If, however, the filling adapter has not been connected to anaesthetic agent bottle securely and tightly enough, anaesthetic agent may continue to flow into Vapor.

5 **If Vapor is filled above the maximum mark by a few millimetres the anaesthetic agent will start to overflow through an overflow hole.**

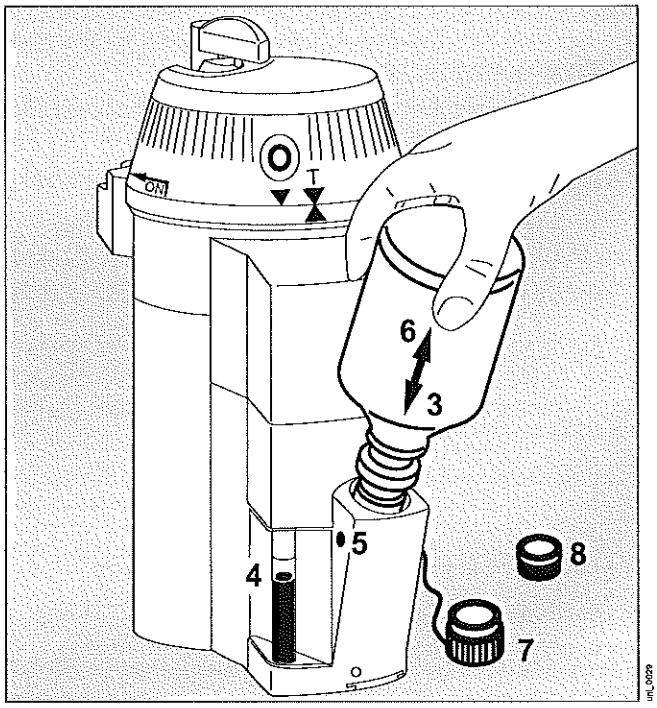
To finish filling process:

6 Reduce pressure on bottle and pull bottle out slowly.

4 Check filling level on sight glass – Vapor must be hanging **vertical** during this check or standing upright.
Filling level must be visible and not above maximum mark.

If maximum mark has been exceeded there is a **risk of incorrect output concentration**, so:

- Empty Vapor at least to maximum mark,
see "Draining Vapor", page 41.



7 **Tighten screw cap firmly. If this is not done properly fresh gas and anaesthetic agent may escape when Vapor is next switched on.**

8 Screw cap onto bottle adapter.

Always keep bottle closed.

Vapor with filling spout

Note warnings on page 13.

If Vapor is connected to anaesthesia delivery system:

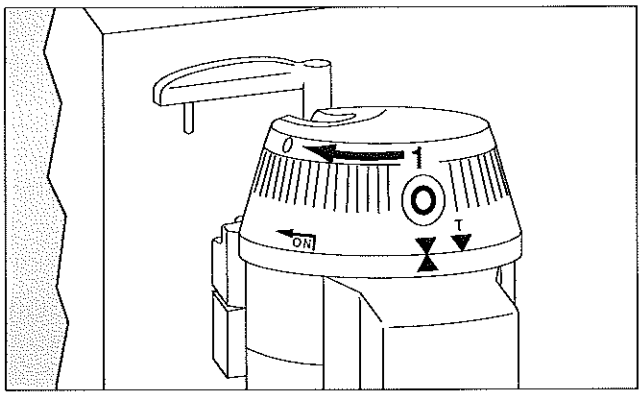
Control dial remains engaged at »0«.

Filling during operation:

- Fresh-gas flow can remain as set.

1 Set control dial to »0«

Wait for 5 seconds for pressure to equalise as fresh gas and anaesthetic agent vapour may escape.



If Vapor is not connected to anaesthesia delivery system:

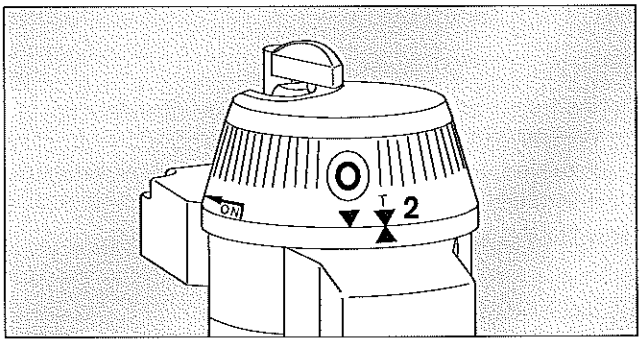
2 Control dial remains engaged at »T«.

- Use correct anaesthetic agent bottle.
  Name of anaesthetic agent and colour coding on Vapor and anaesthetic agent bottle must correspond.

3 Unscrew cap from anaesthetic agent bottle.

4 Unscrew locking cap **slowly** from filling inlet, so that any pressure in Vapor can escape slowly.

5 Pour anaesthetic agent slowly into the **inner** filling funnel.



Do not allow anaesthetic agent to overflow. Do not pour any anaesthetic agent between inner filling funnel and housing – anaesthetic agent may overflow.

- Note filling level on sight glass.

If maximum mark has been exceeded:

6 **When Vapor is filled above maximum mark by a few millimetres, the anaesthetic agent will start to overflow through an overflow hole.**

7 Check filling level on sight glass – Vapor must be hanging **vertical** during this check or standing upright. Filling level must be visible and must not exceed maximum mark.

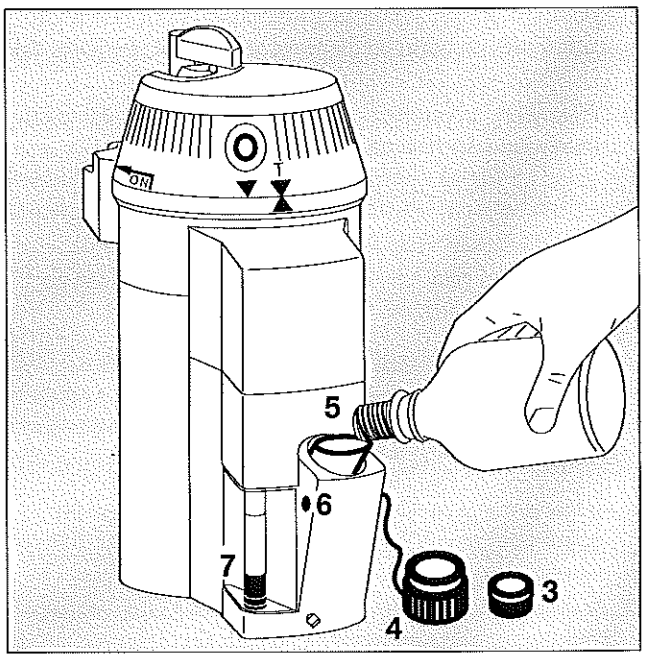
If maximum mark has been exceeded there is a **risk of incorrect output concentration**, therefore:

- Drain Vapor to at least maximum mark, see "Draining Vapor", page 41.

4 Tighten screw cap firmly. If this is not done properly, fresh gas and anaesthetic agent may escape when Vapor is next switched on.

3 Close bottle, even if completely empty, allow any residues of anaesthetic agent to evaporate under extractor fan, if possible.

If this is not done properly anaesthetic agent may escape into ambient atmosphere.



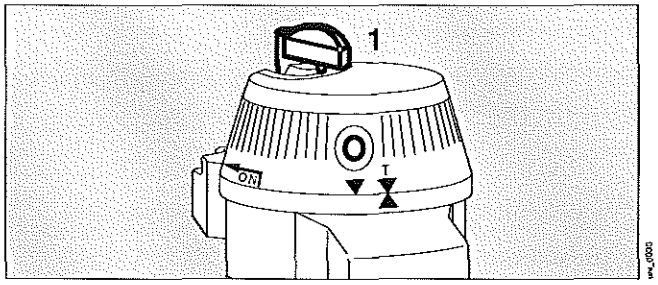
Connecting Vapor

Control dial must be engaged at »T«.
If this is not the case: check concentration before operation, see page 32, "Transport, procedure after tilting".
If Vapor is going to be used on SA2 or Titus anaesthesia delivery systems, check that these have been modified for use with Vapor 2000 (see page 12).

Vapor with plug-in adapter

1 Locking lever must be in position over control dial.

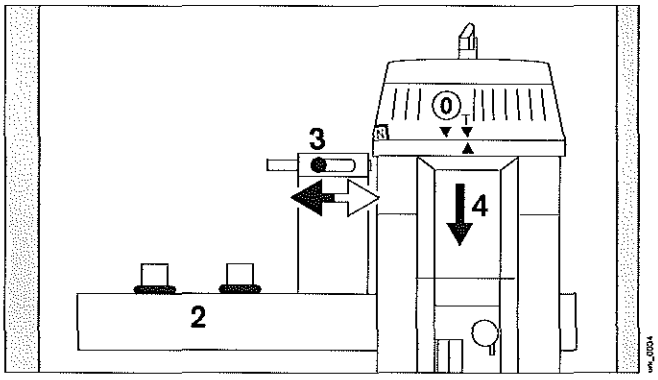
2 Sealing rings on both pins must be undamaged. There should be no foreign bodies on plug-in connector.



Anaesthesia delivery systems with several plug-in connectors:

Two plug-in connectors and Interlock 2:

3 Before hooking Vapor on, slide latch on Interlock 2 to opposite position.
If a Vapor has already been connected and is in operation, it must first be set to »0«.



Several Selectatec-compatible plug-in connectors:

- Switch off vaporisers on other plug-in connectors. Control dial to »0« or »OFF«.
- When several vaporisers are connected, they must always be right next to each other.
  For Interlock to operate, it is essential that there is direct contact on the Interlock pin.
  For triple plug-in connectors with built-in transmission of safety locking between the two outer plug-in positions, the middle plug-in position may remain unoccupied.

4 Hold Vapor in vertical position with both hands and lower gently onto the pins on the plug-in connector.

Risk of injury by trapping finger.

For multiple Dräger Auto Exclusion plug-in connectors:

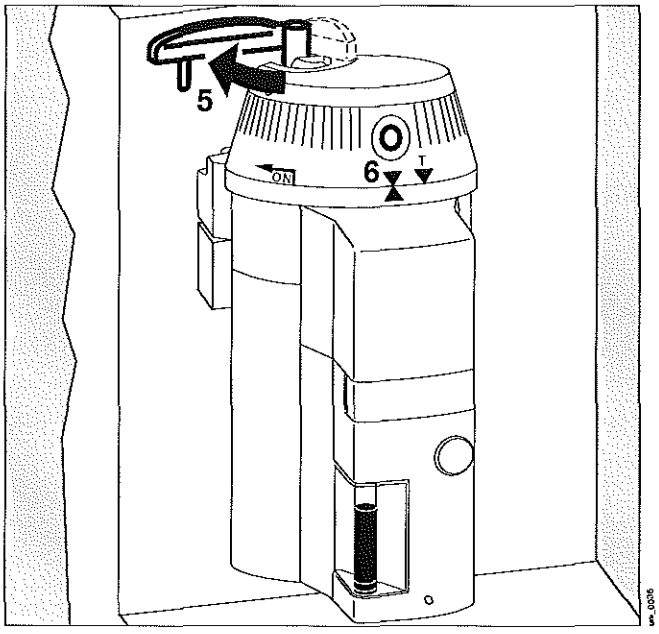
- Vapor 2000 with Auto Exclusion plug-in adapter can be connected to any free Dräger Auto Exclusion slot.

The plug-in adapter must be level and stable on the sealing rings. If this is not the case, there may be a loss of fresh gas, leaks, excessively low output concentrations or the Interlock locking device may jam.

If this is the case: "Disconnecting Vapor" see page 28, check positions of lever and stop-mechanism, and then re-connect Vapor.

5 Swing locking lever clockwise through 90° until it engages. The Vapor is then secured and cannot be removed.

6 Press »0« button and set control dial to »0«.



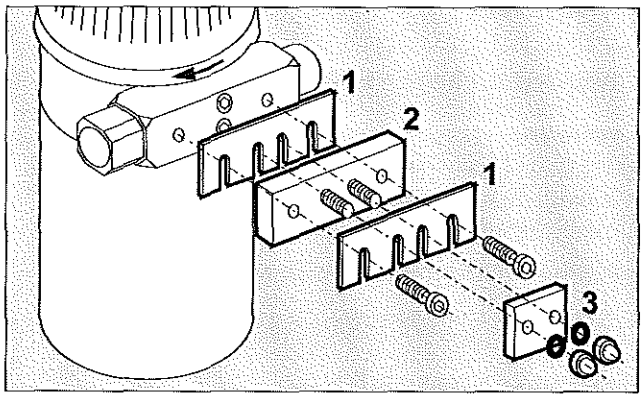
Vapor with conical connectors without Interlock system

- Insert Vapor in fresh-gas line.

1 For anaesthesia delivery systems with rigid conical connectors, adjustment plates may be used for alignment: Between connecting piece and connecting plate and/or connecting plate and anaesthesia delivery system. Ensure adequate screw length – at least 4 engaged threads. If necessary, use longer screws, strength at least 500 N/mm^2.

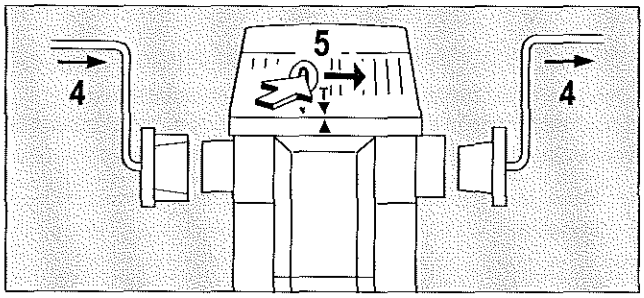
2 Fasten connecting plate to connecting piece using M6 DIN 912-A4 cap screws, torque (7±0.5) Nm.

3 Tighten Vapor with clamping plate and two M6 DIN 1587M-A4 cap screws and two washers A6,4 DIN 125-A4.



The Vapor should not be used in a breathing system. Risk of incorrect output concentration and high resistance may affect breathing.

4 Connect gas inlet line and outlet line to Vapor.



Make sure that the direction of flow is correct and corresponds with the arrow on the back of the Vapor, see page 11.

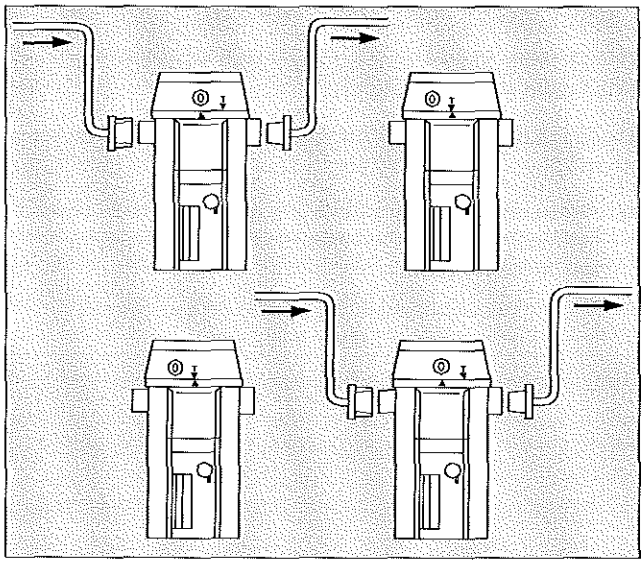
5 Press »0« button and move control dial to »0« until it engages.

Secure free-standing Vapor against tilting and falling. Risk of injury.

Make sure that only one Vapor is used at any one time and that only one Vapor is connected at any one time. If this is not done, mixtures or concentrations which are too high may be delivered.

On the Vapor which is not being used:

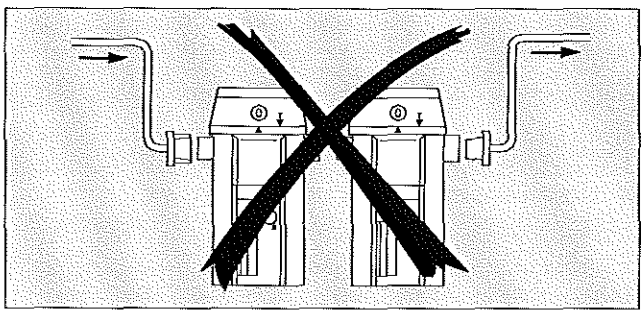
- press »0« button and move control dial to »T« until it engages.



When using several Vapors with conical connectors:

Never connect Vapors in series.

If Vapors are connected in series without an interlock system there is a risk that several Vapors will be switched on and be operational at the same time. If this happens, gas containing anaesthetic agent would flow from one Vapor into the vaporising chamber of another Vapor resulting in uncontrolled mixtures.



Operation

Checklist – checks before each use

Conditions:

- Operating parameters (e.g. temperature) as specified for the application – otherwise, wait for temperature to equalise with ambient temperature (see page 30).

High temperatures at low atmospheric pressures (high altitudes) may result in an uncontrolled excessive dosage, see page 54.

- Operation in magnetic field
  Vapors must not be changed or left unsecured in magnetic fields.

Vapor can be moved by magnetic attraction. Risk of injury.

Only use anaesthesia delivery systems and accessories designed for use in magnetic fields. Use only suitable adapters and drain adapters for filling and emptying the Vapor.

- Operation at an angle, e.g. in portable anaesthesia delivery systems:

At *an angle of more than 10° an unsecured Vapor may* tilt. If a Vapor is operated at an angle of more than 30° uncontrolled concentrations may occur. (see "Transport, procedure after being tilted", page 32).

Connections, plug-in connectors/plug-in adapters may leak when used at greater angles.

The filling level shown in the sight glass will not be correct when Vapor is used at an angle. This may lead to overfilling.

- Anaesthesia delivery system prepared in accordance with Instructions for Use and anaesthetic gas scavenging system connected.
- Anaesthetic-agent monitor switched on and correct anaesthetic agent set. Alarm limits set.

Dräger recommend monitoring with a monitor with continuous measurement and upper and lower alarm limits to detect any hazardous output values due to deviations in *concentration, leaks or incorrect filling, particularly for* Vapors with filling spout. For this reason, monitors should be used which can differentiate between different anaesthetic agents.

When using Low Flow and Minimal Flow, the concentration in the breathing system may deviate significantly from the Vapor setting. For this reason, measurement of inspiratory and/or expiratory anaesthetic agent concentration is essential.

- Oxygen monitor switched on. Alarm limits set.

Dräger recommend monitoring with a monitor with continuous measurement and at least a lower alarm limit to detect an insufficient oxygen supply, e.g. due to leaks.

Setting/checking:

- Filling level in sight glass between minimum and maximum mark – must not exceed maximum mark.
- Filling system:
  - Keyed filling system: locking lever fully in place and lever locked.
  - Quik Fil or funnel filling system: screw cap in place and securely tightened.
- Connector system:
  - Plug-in connector: plug-in adapter level on the seals. Locking lever swung to the left. Vapor secure and hanging vertical on machine, when viewed from front and side.
  - Other connector: Vapor connected firmly and securely on anaesthesia delivery system. Vapor is suspended or stands upright and is secured against tilting or falling.
- Direction of flow corresponds to arrow.
- For several connectors:
  - All connectors occupied, if not
  - any unoccupied permanent and conical connectors or plug-in adapters without valve function, must not be open for operation.

If these are not done, fresh gas and anaesthetic agent vapour will escape, interrupting the patient's supply.

- Only one vaporiser connected at a time, if not:

- check that there is an Interlock system on vaporiser and anaesthesia delivery system, and that it is of same type.

A malfunctioning Interlock may endanger the patient by causing overdosing or a mixture of anaesthetic agents.

- Fresh-gas flow must be switched off.

- Check each vaporiser connected as follows:
  - Set vaporiser to any concentration.
  - All other vaporisers must be switched off, locked off and impossible to switch on.
  - If there is an anaesthetic-agent vaporiser checking system, check that the correct anaesthetic is indicated and that it matches the Vapor connected.

If these are not done, an incorrect concentration may be displayed.

- Switch off vaporiser – control dial set to »**0**«.

- Check that Vapor, connector and fresh-gas lines are leak-tight (see Instructions for Use for Anaesthesia Delivery System):
  - control dial setting »**0**« and »**T**«
  - control dial setting ≥0.2 vol.%.

- Flush the breathing system with fresh gas before connecting a patient.

Do not operate Vapor unless all checks have been carried out satisfactorily. Any repairs must be carried out by qualified service personnel.

Adjusting concentration of anaesthetic agent

- First set flow of fresh gas on anaesthesia delivery system,

If control dial is set to »T«:

- press »0« button, set control dial to »0«, wait 5 seconds for pressure to equalise.

1 **Press »0«** button and

2 turn control dial anti-clockwise to the concentration of anaesthetic agent required.

If concentration cannot be set:
Do not force control dial.
Check that all other vaporisers connected are in **»0«** or **»OFF«** position and that Interlock is operational.

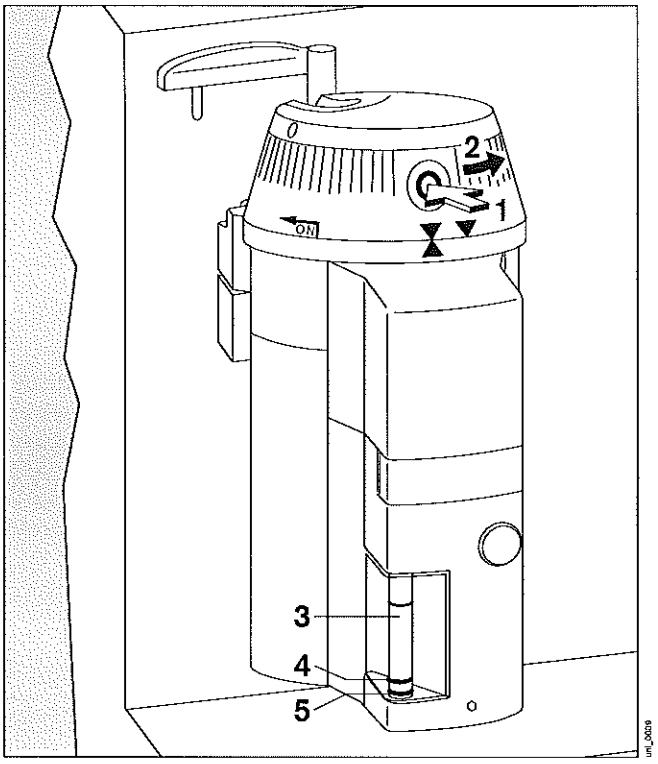
No settings between »0« and »ON«.
In this range concentrations cannot be defined.

3 Check filling level in sight glass regularly. This must be visible between minimum and maximum marks.

If not, do not use Vapor. Vapor could be empty or overfilled, and output concentration could be incorrect.

4 When this mark is reached, Vapor may be refilled with 250 mL (usual anaesthetic agent bottle).

5 When minimum mark is reached, at the latest: see pages 13 to 21, "Filling Vapor".



If the anaesthetic agent monitor shows implausible values, check Vapor for incorrect filling, particularly Vapors with filling spout, and check monitor for wrong setting.

During prolonged operation with both a high flow of fresh gas and a high concentration, the concentration administered may decrease.
Be careful about temperature range, see page 48.

An anaesthesia delivery system may be moved at the workplace with Vapor switched on.

Jerky movements or tilting at an angle of more than 30° can cause incorrect output concentration.

Changing anaesthetic agent

- Set Vapor being used to »0«.
- Switch anaesthetic agent monitor to new anaesthetic agent.

If only one Vapor is connected or if one of the connected Vapors is to be replaced:

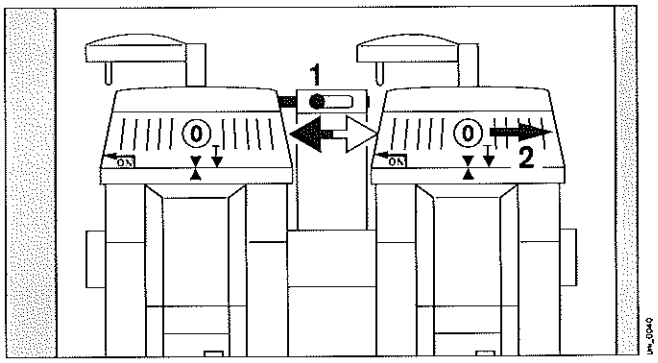
- "Disconnecting Vapor", see page 28.
- "Connecting Vapor", see page 22.

Two Vapors with Interlock 2:

1 Slide latch on Interlock 2 into the control dial on the Vapor which has been used until it engages.

On Vapor to be used:

2 Press »0« button and set control dial to anaesthetic agent concentration required.



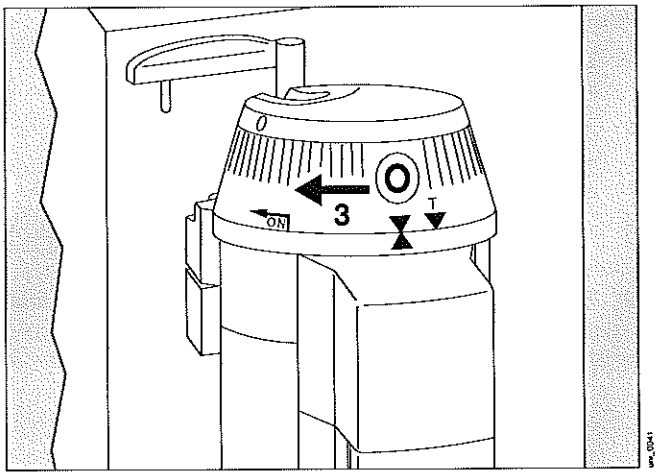
Ending administration of anaesthetic agent

3 Switch off Vapor: control dial engaged at »0« to prevent it being switched on accidentally.

Then, if required:

- Switch off fresh-gas flow on anaesthesia delivery system.

Fresh gas flow must never be switched off before Vapor is switched off. Vapor must never be left switched on without a fresh-gas flow.
Anaesthetic agent vapour at a high concentration can get into machine lines and ambient air and harm people and materials.



End of use

When Vapor is not going to be used for up to six months, it may remain filled;
if Vapor is not going to be used for more than 6 months, see "Shut down", page 41.

If Vapor remains on machine:

- For intervals of more than one week, anaesthetic agent loss from the vaporiser chamber can be minimised by using the »T« setting.
- Locking lever on plug-in adapter should remain locked off.
- Keep within permissible temperature range, see page 48.
- Observe use-by date of anaesthetic agent.

If not:

- see "Disconnecting Vapor", page 28, and "Transport when filled", page 29.

Disconnecting Vapor

Take care not to drop Vapor. Do not re-use Vapor if it has been dropped. Damage may cause incorrect output concentration.
Do not carry by the control dial, control dial caps or locking lever for the plug-in adapter.
Risk of injury.

Disconnect Vapor only when control dial is set at »T«.
Risk of incorrect output concentration and of anaesthetic agent escaping otherwise.

Place Vapor only on firm even surfaces or hang from stable brackets. Vapor could be damaged.
Risk of injury.

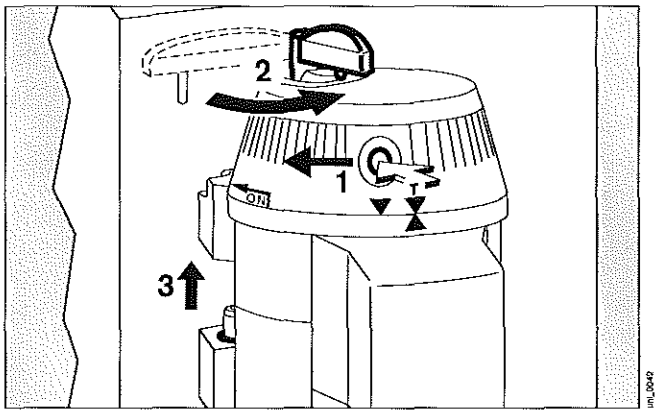
Plug-in connector

- When necessary: switch control dials of adjacent anaesthetic vaporisers to »0« or »OFF«.
- Anaesthesia delivery systems with two plug-in connectors and Interlock 2:
  Slide latches to opposite positions.

1 Press »0« button and turn control dial clockwise to »T« until it engages.

2 Turn locking lever 90° anti-clockwise and engage in control dial.

3 The Vapor can now be lifted off the plug-in connector smoothly, using both hands.



For plug-in connectors without valves in this condition, the fresh-gas supply is now disconnected. Fresh gas and anaesthetic agent vapour may escape.

When operating an anaesthesia delivery system with several vaporisers and Interlock S, Interlock S may cease to function effectively when one vaporiser is disconnected.

For Auto Exclusion plug-in connector

1 Press »0« button and turn control dial clockwise to »T« until it engages.

2 Turn locking lever 90° anti-clockwise and engage in control dial.

3 The Vapor can now be lifted off the plug-in connector smoothly, using both hands.

For conical connectors

1 Press »0« button and turn control dial clockwise to »T« until it engages.

2 Detach gas supply and gas delivery line from Vapor.

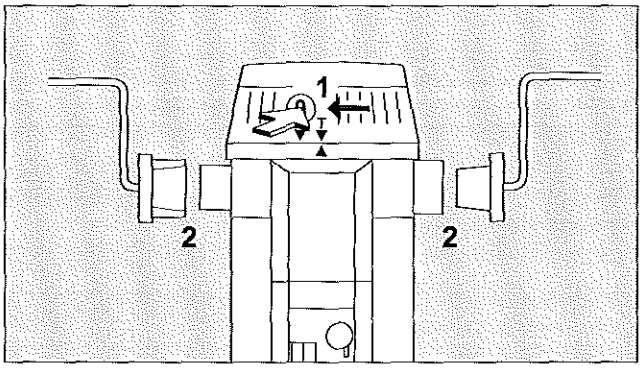
- The Vapor can now be disconnected.

The fresh-gas line is now disconnected. Fresh gas and anaesthetic agent vapour may escape.

- If fresh gas is to flow to breathing system, gas supply and delivery line must be connected securely together.

Permanent connection

Only trained service personnel may disconnect Vapor.



Transport when filled

by itself or with transportable anaesthesia delivery system, for instance.

Only to be done as part of normal clinical operation, not for storage and despatch.
"Storage", see page 46,
"Despatch", see page 46.

Only to be done when ambient conditions are in accordance with "Technical Data – Shutdown", see page 48.

An anaesthesia delivery system can be moved around at the workplace with Vapor switched on.

Jerky movements and tilting at an angle of more than 30° can cause incorrect output concentration.

Anaesthesia delivery systems with securely fastened Vapors may be moved within or between buildings with hand-wheel set at »0«, if there is no risk of tilting by more than 30°.

When tilted at an angle of more than 30°
- **anaesthetic agent may overflow when control dial is set at »0«. Danger to health.**
- **when control dial is set above »0«, anaesthetic agent may leak and get into the flow control system and cause excessively high or low concentrations when Vapor is next used.**

Disconnect detachable Vapors from anaesthesia delivery systems and transport separately.

For Transport – control dial must always be engaged at »T«.

Always make sure that Vapor is appropriately secured against tilting at an angle or falling every time it is transported, in compliance with the Instructions for Use for Anaesthesia Delivery Systems, and that it is packed safely to prevent damage.

It is recommended that Vapors are kept in an upright position, though other positions are allowable in the »T« setting.

Fault – Cause – Remedy

Fault	Cause	Remedy
Operation:		
No concentration delivered or concentration excessively high/low	*Vapor not full, Vapor empty*	Fill Vapor
	Control dial setting at »0« or »T«	Set control dial to ≥0.2 vol.%
	No Vapor connected, or if several connections, one unoccupied and open	Connect Vapor, or close open connections with Vapor or by direct gas connections
	Vapor tilted during or before operation when control dial not at »T« setting. If this has happened, liquid anaesthetic agent may have entered flow control system	**Before operation: flush and then check concentration,** see "Transport, procedure after tilting", page 32
	Vapor filled with incorrect anaesthetic agent or mixture of agents	Drain Vapor and blow off, see pages 41 to 46, *Repair**
	Gas is flowing through Vapor in wrong direction	Check connection system, see page 11
	Leak, e.g. plug-in adapter is not fitted flush on seals	Disconnect Vapor; check plug-in adapter *safety locking device and sealing rings*; replace. Leak test with Vapor at control dial setting »0« and ≥0.2 vol.%
	Leak at connector, e.g. Vapor connected to SA2 or Titus which are not modified for Vapor 2000, see page 12	Have modification carried out by DrägerService
	Valves in plug-in connector damaged	Repair*
	Vapor temperature outside specified application range, e.g. filled with very cold anaesthetic agent, or operated with both flow and concentration high over a *prolonged period*	Allow Vapor to reach normal temperature, allowing at least 15 min per °C deviation from specified range, see page 54; refill with anaesthetic agent at room temperature
	Vapor being operated with carrier gas *other than air*	Concentration changed because of carrier gas, see pages 39 and 56
	Monitor displays volume percentage, not *partial pressure*	To convert measured value to partial pressure, see page 40
	Vapor or anaesthetic monitor faulty	Check with another Vapor to establish whether Vapor or anaesthetic agent monitor faulty, repair*

* *to be carried out only by trained service personnel*

Fault	Cause	Remedy
The vaporiser detection system on anaesthesia delivery system to which Vapor is connected displays anaesthetic agent which is different from the Vapor	Coding of plug-in adapter or Vapor damaged, faulty, or incorrectly fitted	Check coding, if necessary re-fit, repair*
Monitor indicates different anaesthetic agent from that on the Vapor (applies only to anaesthetic agent monitors with anaesthetic-agent detection system)	A different anaesthetic agent has just been used and high concentrations of it are still present in the breathing system	Flush breathing system or wait for gas to change
	Monitor has not been switched over after anaesthetic agent has been changed	Switch over monitor
	Incorrect anaesthetic agent or anaesthetic agent mixture in Vapor	Check Vapor, drain and blow off, see pages 41 to 46; repair*
Control dial cannot be set to concentration	»0« button not pressed	Press »0« button
	Interlock not switched over; Interlock jamming or another vaporiser still switched on	Switch off other vaporiser and switch over Interlock. Checks, see page 27; repair*
Control dial can be moved from »0« to »T« without pressing button	»0« button defective	Repair*
Smell of anaesthetic agent, anaesthetic agent vapour leaking, leakage too high during leak test	Plug-in adapter not fitted flush	Check plug-in connector sealing rings and sealing surfaces; alternatively locking lever not engaged or was twisted before connection
	Leak on connector, e.g. Vapor connected to SA2 or Titus which are not modified for Vapor 2000, see page 12	Have modification carried out by DrägerService
	Locking device on filling system not tightened, or defective seals	Tighten locking device on filling system, or check seals, replacing if required, or repair*
	Drainage screw not closed	Screw drainage screw tight
	Lever of keyed filling system too loose so that seals not compressed enough	Adjust lever; repair*
	Sealing block on filling system not fully pushed in	Loosen lever, push sealing block in fully, re-tighten lever

* to be carried out only by trained service personnel

Fault	Cause	Remedy
Filling level cannot be read in sight glass	Vapor completely empty	Refill Vapor
	Vapor overfilled	Drain Vapor to maximum mark. Check concentration
	Sight glass display faulty	Repair*
Anaesthetic agent is obscured in sight glass.	Halothane contains thymol, which has accumulated in the vaporiser	Drain discoloured substance completely; clean Vapor, see page 38

Transport, procedure after tilting:

Anaesthetic agent has leaked	Control dial not engaged at »T« and Vapor tilted at an angle of more than 30°	Place Vapor upright. Set control dial to »T« and engage. – Flush Vapor for 2 hours at 10 L/min or 8 hours at 4 L/min. – Set Vapor at maximum concentration and flush for 5 minutes at 10 L/min. – Check concentration at 0.5 L/min. Air with control dial set at »0«. Concentration must be less than 0.1 vol.%. If not, flush as above. Check concentration, see page 39. If output concentration is not within permissible range, do not use Vapor. Repair*
Vapor not set at »T«, even though it is not connected to anaesthesia delivery system	Vapor may have been tilted at an angle of more than 30° when last handled. Liquid anaesthetic agent may have leaked or entered flow control system to give incorrect concentration	Flush before start-up and check concentration, see above
Smell of anaesthetic agent during or after transport	Anaesthetic agent vapour may escape or liquid anaesthetic leak because of pressure in Vapor when an extreme rise in temperature and/or drop in atmospheric pressure has occurred, see page 49	**Do not inhale anaesthetic agent vapour. Ventilate room.** Allow Vapor to reach normal temperature. Do not exceed application range for filled Vapor with control dial set at »T« see page 48. Flush before start-up and check concentration, see above.

* to be carried out only by trained service personnel

Fault	Cause	Remedy
Draining and filling Vapor:		
Anaesthetic agent is leaking from drainage outlet	Drain valve not closed	Close drain valve
Vapor accidentally filled with incorrect anaesthetic agent		Drain Vapor completely and blow off, see pages 41 to 46; repair*
Anaesthetic agent does not flow into Vapor	Filling adapter being used without check valve	Use filling adapter with check valve or modify
Anaesthetic agent leaks from bottle thread	Filling adapter not screwed tight enough on bottle	Screw filling adapter on firmly
	Seal in screw-cap on filling adapter missing or damaged	Check seals, Repair*
Anaesthetic agent leaks from filling system	Filling adapter not inserted properly or lever not tightened properly	Loosen lever, push filling adapter in as far as it will go; tighten lever
	Lever does not press down sufficiently firmly onto filling adapter	Adjust lever, Repair*
	Filling adapter damaged	Use another filling adapter, Repair*
	Seal on filling system damaged	Leak test Vapor with control dial set at ≥0.2 vol.%. Repair*
Anaesthetic agent is leaking from overflow	Vapor filled above maximum	Drain Vapor to maximum mark; check concentration
Sealing block cannot be removed	Lever not opened enough, or lever incorrectly set	Open lever more, or get it adjusted*
Anaesthetic agent does not flow out when draining	When control dial is set at »T« vaporiser chamber is hermetically sealed	When draining with control dial set at »T« open locking device on filling outlet; close filling outlet again tightly after draining
Quik Fil drain adapter overflows	Drain valve opened too far	Do not open drain valve so far
	Bottle screwed on incorrectly or not fully so that bottle valve does not open	Unscrew bottle from drain adapter, screw back on again
	Bottle full	Unscrew drain adapter and screw onto another suitable bottle; continue draining

* to be carried out only by trained service personnel

Fault	Cause	Remedy
Plug-in adapter:		
Locking lever does not engage in control dial when disconnected	Control dial still set at »0«	Set control dial to »T« and engage
Locking lever cannot be swung out of the control dial	Control dial to »0« or ≥0.2 vol.%. During preceding transport, control dial may have been set at »0« or ≥0.2 vol.%, liquid anaesthetic agent may have entered the flow control system to give an incorrect concentration	Set control dial to »T« and engage. **Flush before start-up and check concentration:** see page 32, "Transport, procedure after tilting"
Vapor cannot be disconnected	Control dial not set at »T«	Set control dial to »T« and engage
	Interlock still engaged	Disengage Interlock
	Locking lever cannot be swung back into control dial; locking device between plug-in adapter and plug-in connector is jammed	Remove locking cap on top of locking lever shaft; loosen screw in shaft with 3 mm hexagon socket spanner so that Vapor can be disconnected; Repair*
Plug-in adapter not fitting flush on plug-in connector seals	*Locking lever not engaged in hand-wheel*, as control dial is set at »0« or ≥0.2 vol.%	Set control dial to »T« and engage; insert pin on locking lever into socket on control dial and engage
	Engagement mechanism on plug-in adapter or plug-in connector damaged	Excessive force used may lead to jamming or problems when disconnecting. Repair*
	Locking lever was turned to the left *before connection*	Disconnect Vapor (control dial at »T«); *engage locking lever in hand-wheel;* reconnect Vapor
	O-rings on plug-in adapter missing	Fit O-rings
	Extra O-ring on a pin on the plug-in connector or foreign body between plug-in connector and plug-in adapter	Remove O-ring or foreign body
For plug-in adapter S-2000 only: Control dial cannot be turned	Interlock pins are not in their original position	Check whether control dial can be turned after adjacent vaporisers have been disconnected; squeeze both interlock pins inwards by hand, one after the other, and release. If this does not correct the problem, repair*

* to be carried out only by trained service personnel

Care

Do not immerse Vapor and filling adapter in detergents.

Detergents must not be allowed to get under the control dial.

Do not allow detergents to get into the gas inlet or gas outlet, or the filling system.

If liquids other than the anaesthetic agents specified for the Vapor get into the Vapor, the patient may be harmed.

Do not sterilize Vapor or filling adapter. Damage inside may cause incorrect output concentration.

Do not use solvents on Vapor.

Cleaning

Wipe heavy stains off with disposable cloth.

Disinfecting

Use surface disinfectants for disinfection. For reasons of material compatibility use disinfectants based on:

- aldehydes,
- alcohols,
- quaternary ammonium compounds.

Follow the manufacturers' instructions for use.

Do not use preparations which are based on:

- **halogen-releasing compounds,**
- **strong organic acids,**
- **oxygen-releasing compounds.**

We recommend that disinfectants on the current DGHM (DGHM: German Society for Hygiene and Microbiology) (mhp-Verlag GmbH, Wiesbaden, Germany) are used. This gives the composition of each disinfectant.

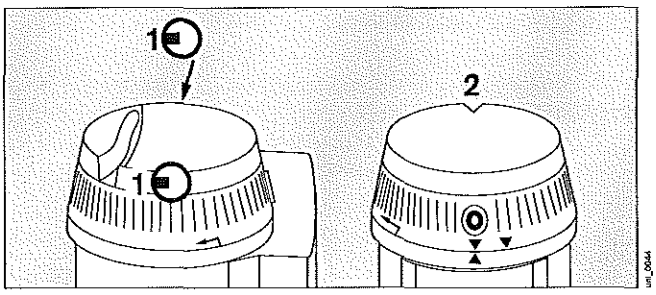
Disinfecting in Aseptor

- Wipe heavy stains off with disposable cloth.
- Vapor must be connected to anaesthesia delivery system and anaesthesia delivery system must be approved for disinfecting in Aseptor. Vapor can remain filled.
- Control dial engaged at »T«.
- Disinfect in accordance with Instructions for Use for Aseptor. Only use programmes with temperatures below 40 °C.

Checking Readiness for Operation

Test after care and service of anaesthesia delivery system or Vapor, after prolonged shutdown and at least every six months.

- Previous inspection less than 6 months ago.
- Accompanying documents/Instructions for Use present.
- No damage on Vapor and no loose parts.
- Anaesthetic agent display on Vapor, colour code on cover plate and other anaesthetic-agent-specific codings, when present (e.g. identification initials or codings on plug-in adapter), are all consistent (see page 13).
- Gas inlet and gas outlet are not soiled.
- Control dial engages at »0« setting as well as at »T« setting and cannot be turned without »0« button being pressed.
- After »0« button has been pressed, control dial can be turned right to the stop, close to highest concentration mark.

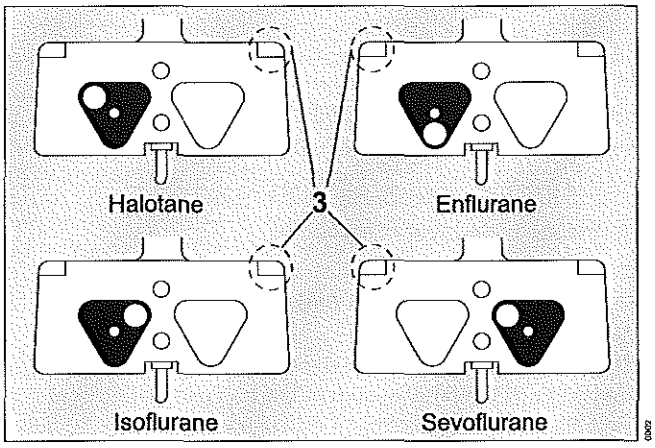


- Interlock disc rests firmly on control dial.

1 Interlock 2 and Dräger Auto Exclusion:
nibs are present in both openings and are undamaged.

2 Interlock NMD:
Notch at the back when control dial set at »0«.

3 Plug-in adapters must not be fitted to Vapor with an Interlock NMD control dial cap.

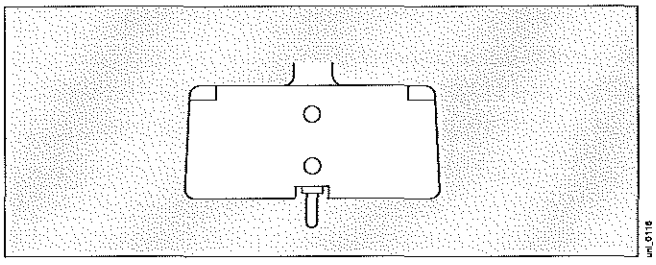


Plug-in adapter DW-2000, Dräger Auto Exclusion and S-2000:

Vapor not on plug-in connector:

- Turn locking lever to locking position – it must turn back automatically.
  Re-engage locking lever in control dial.

The newer version of the DW-2000 plug-in adapter, the Auto Exclusion plug-in adapter and S-2000 plug-in adapter do not contain an anaesthetic agent code.



Plug-in adapter DW-2000:

Only use white plug-in adapter for Vapor 2000.

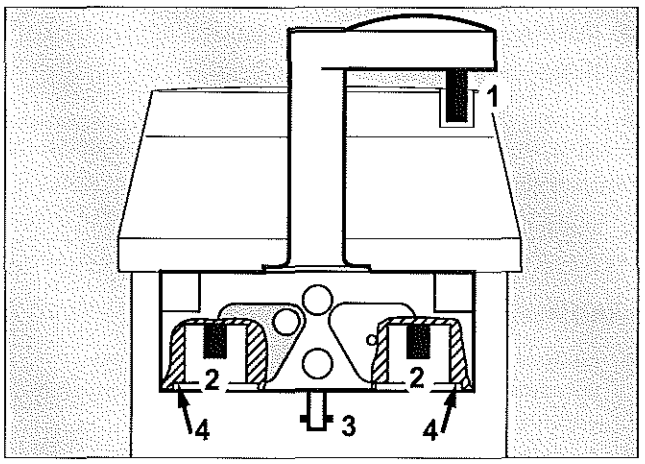
(Vapor 19.n plug-in adapters, which are silver in colour, must never be used on Vapor 2000).

1 Drop-in pin on locking lever secure and straight.

2 Valve control pins both present.

3 Transverse pin at the bottom of the locking lever is tight, in the centre and not buckled.

4 Sealing surfaces undamaged.



Dräger Auto Exclusion plug-in adapter:

5 Drop-in pin on locking lever secure and straight.

6 Valve control pins both present.

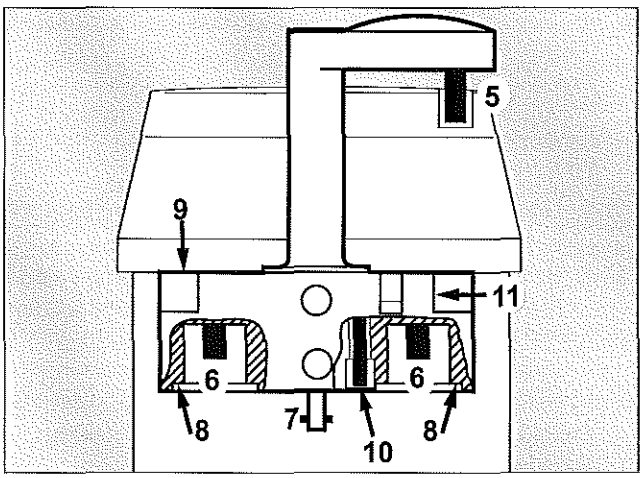
7 Transverse pin at the bottom of the locking lever is tight, in the centre and not buckled.

8 Sealing surfaces undamaged.

9 Cover plate present and undamaged.

10 Auto Exclusion transmission pin present, moveable and cannot be removed.

11 Bearing pin present, tight and flush with housing.



Plug-in adapter S-2000:

Only use white plug-in adapters for Vapor 2000.

(Vapor 19.n plug-in adapters, which are grey in colour, must never be used on Vapor 2000).

12 Stop mechanism undamaged, not buckled.

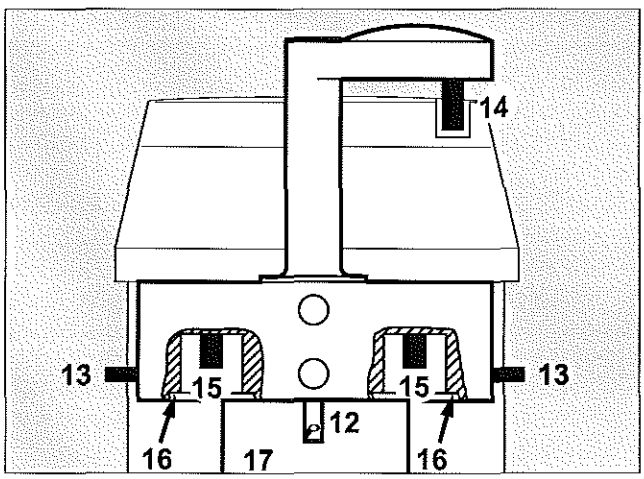
13 Interlock pins undamaged, glide easily and cannot be removed.

14 Drop-in pin on locking lever secure and straight.

15 Valve control pins both present.

16 Sealing areas undamaged.

17 Manufacturer's plate on the back of Vapor present and secure.



Conical connector:

- Male cone connected to Vapor inlet.
- Female cone connected to Vapor outlet.
- Cones and sealing surfaces undamaged.

Permanent connection:

- Vapor fixed securely to connector.

Keyed filling system and Quik Fil:

- Filling adapter coded on both ends for the correct anaesthetic agent. Seal present in bottle connector and undamaged.
- Only the correct filling adapter fitted into the filling opening.
- Anaesthetic agent in unstained sight glass. Any stains must be removed by trained service personnel.
- Anaesthetic agent in sight glass which is not discoloured. Halothane, for example, contains thymol to stabilise it. Thymol and other reaction products may gradually accumulate in the wick and the vaporising chamber and colour the Halothane yellow.
  If this has happened:
  - Drain off discoloured anaesthetic agent, see pages 41 to 45.
  - Re-fill to the maximum mark with fresh anaesthetic agent (see pages 13 to 21), allow to interact for about 6 hours and then drain completely.
  - Dispose of drained anaesthetic agent in accordance with local regulations.

  If yellow discolouration persists, have wick replaced by trained service personnel.
- Check output concentration of anaesthetic agent weekly, when continuous monitoring is not available, see page 39.
- Check Vapor in accordance with Checklist, page 24.

Checking concentration

Weekly, when continuous monitoring is not available.

Preparation

- Fill Vapor – at least half full between minimum and maximum mark.
- Allow the filled Vapor to warm up to room temperature of 20 to 24 °C.
  Wait long enough for the temperature to equalise – the time will vary depending on the temperature difference ΔT:

ΔT	up to ±2 °C	±6 °C	±10 °C	±20 °C
Hours	1	3	4	5

- Check anaesthetic agent monitor. Carry out zero calibration on monitor with gas required (Air or O_2).
- Connect monitor to fresh-gas outlet or Y-piece.
  Make sure that the connections are leak-tight.
- Connect scavenging line and start operation.

Setting

- Switch off ventilator or set so that the ventilation pressure is less than 5 mbar.
- Set monitor to anaesthetic agent being used and to continuous measurement.
- Set flow of 2.5 to 4 L/min Air.
  Use O_2 if Air is not available.
- Let Vapor dose for about 1 to 2 minutes with a flow of 2.5 L/min and the anaesthetic agent set to maximum concentration.

Measuring

Check »**0**« and »**T**« marks, 1 and 4 vol.% as well as at least 3 concentrations in ascending order.
Set control dial.
Take reading of measured value once it has stabilised.

Correcting measured values

depending on carrier gas used

- Air check: no correction.
- O_2 check (see page 56): reduce the measured values as follows:

Measured value vol.%	Correction
≤1.0	–0.05
1.5 to 2.0	–0.10
2.5 to 4.0	–0.20
5.0 to 8.0	–0.30

Display on monitor

- in % partial pressure: no correction.
- in vol.%: convert to partial pressure:

$$\text{Concentration [\% partial pressure]} = \frac{\text{Measured value [vol.\%] x atmospheric pressure [hPa]}}{1013\ \text{hPa}}$$

Determining permissible range

See Accuracy Data ("Technical Data", page 48) for permissible range of output concentration.

Determine the permissible deviation of monitor.

The sum total of both sets of data gives the permissible range for the output concentration for Vapor.

Test result

If the corrected measured value is within the permissible range of output concentration, Vapor may be put into operation.

If the corrected measured value is not within the permissible range:
Do not use Vapor. Patient may be harmed.
Have Vapor checked by trained service personnel.

After test

- Switch off Vapor: set control dial to »0« and engage.

If Vapor is not on anaesthesia delivery system:

- Press »0« button and set control dial to »T« and engage. With plug-in adapter, engage locking lever in control dial.
- Switch off Air or O_2 flow.

Example of concentration test:

Halothane Vapor is being tested at 3 % setting.
Measured value is 3.58.

Measurement was carried out using O_2.
So correct the measured value of 3.58 by −0.2 = 3.38.

Monitor display in partial pressure, so no correction required.

The permissible range is ±20 % rel. of set value, i.e. 2.4 to 3.6 % partial pressure.

The Technical Data for the monitor gives an accuracy of ±5 %, i.e. a tolerance of ±0.18 % partial pressure for a measured value of 3.58 %.

The permissible range is, therefore, increased by this amount to 2.22 to 3.78 % partial pressure.

The corrected measured value of 3.38 is within the permissible range.

Shut-down

Draining Vapor

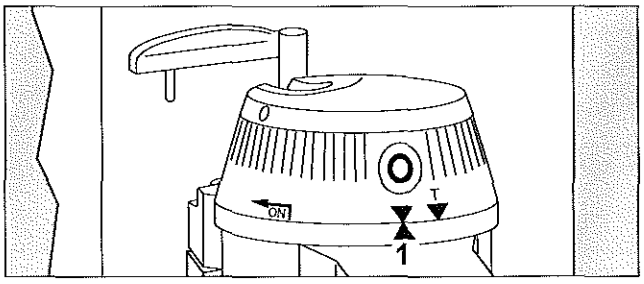
Take care not to spill anaesthetic agent.
Do not inhale anaesthetic agent vapour.
Danger to health.

Recommendation: Drain Vapor under suitable scavenging as small amounts of anaesthetic agent vapour will always escape.

Whilst draining, avoid contamination.

Anaesthetic agent which has been drained off must be handled, stored and disposed of as medicament. If this is not done there will be a risk of administering incorrect anaesthetic agents or mixtures.

- **Place Vapor upright or suspend,**
  so that all the anaesthetic agent can drain off.



Vapor with keyed filling system

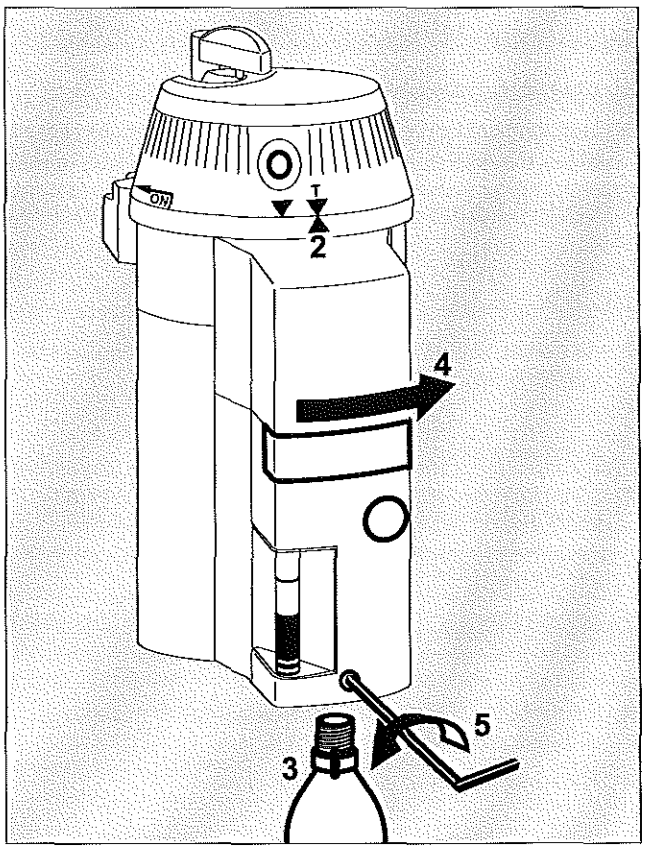
If Vapor is connected to anaesthesia delivery system:

1 Control dial must be engaged at »0«.

If Vapor is **not** connected to anaesthesia delivery system:

2 Control dial remains engaged at »T«.

3 Hold **correct bottle for the anaesthetic agent concerned** below the drainage outlet at the bottom of the filling device.



Check that the name of anaesthetic agents and colour coding on the Vapor and the anaesthetic agent bottle correspond so that dangerous mixtures of anaesthetic agents do not occur.

4 As well as setting control dial at »T«, swing lever over. Sealing block should slide forward.

5 Use 2.5 mm Allen key to turn drainage valve one or two times anti-clockwise.

- Drain until no more anaesthetic agent can be seen in the sight glass and no more anaesthetic agent runs into the bottle.
  If the anaesthetic agent in the wick also needs to be removed, see "Blowing off Vapor", page 46.

Do not fill the bottle to the very top. This can lead to a significant amount of anaesthetic agent escaping.

If necessary, close drainage valve in good time and continue process with a new bottle.

1 Turn drainage valve clockwise to close.

2 Push sealing block in **fully.**

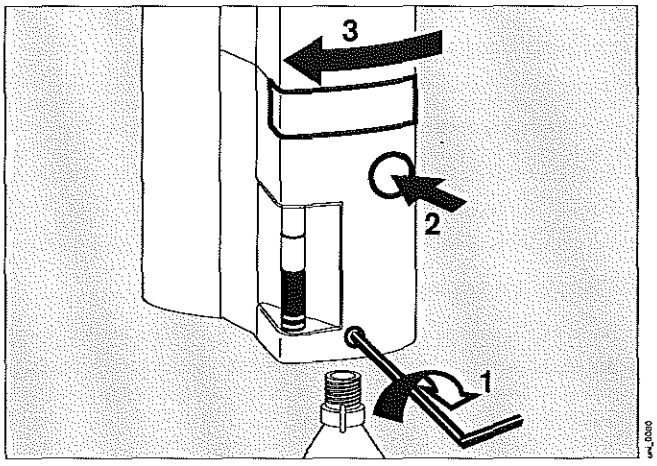
3 Close lever, as fresh gas and anaesthetic agent vapour may escape when Vapor is switched on again, otherwise.

If the lever cannot be closed completely, release lever and push sealing block in **fully**, otherwise the sealing block will not function properly and may damage the seal.

- Close anaesthetic agent bottle.

Anaesthetic agent may otherwise be released.

- Mark bottle. "Used anaesthetic agent".
  Recommendation: **Do not re-use.**

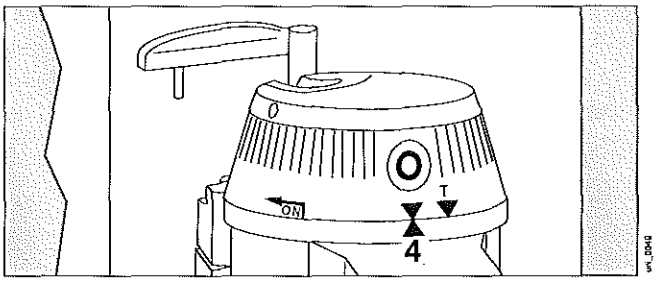


Vapor with Dräger Fill filling system

Note warnings on page 41.

If Vapor is connected to anaesthesia delivery system:

4 Control dial must be engaged at »0«.



If Vapor **is not** connected to anaesthesia delivery system:

5 Control dial remains engaged at »T«.

6 Hold **correct bottle for the anaesthetic agent concerned** below the drainage outlet at the bottom of the filling device.

Check that the name of the anaesthetic agent and colour coding on the Vapor and the anaesthetic agent bottle correspond so that dangerous mixtures of anaesthetic agent do not occur.

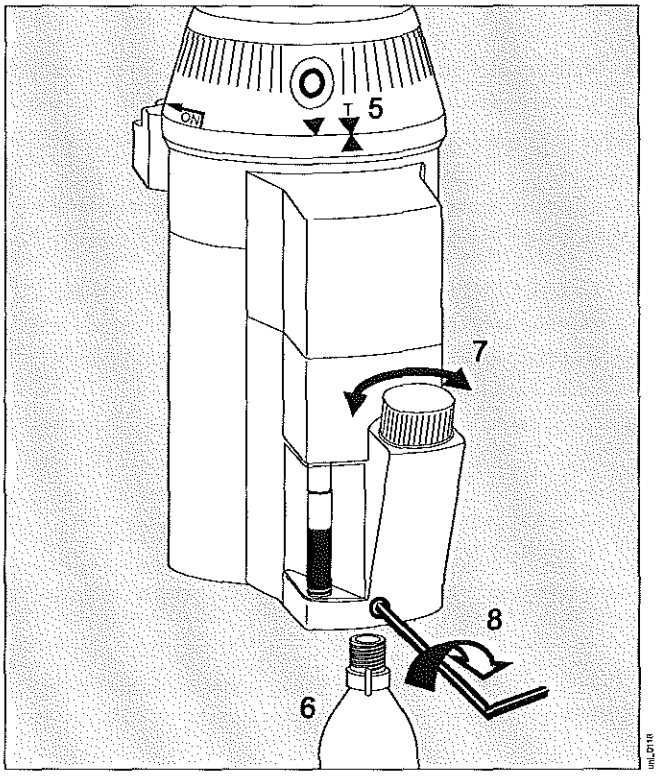
7 As well as setting control dial to »T«, open locking cap on the filling device.

8 Use 2.5 mm Allen key to turn drainage valve one or two times anti-clockwise.

- Drain until no more anaesthetic agent is visible in sight glass and no more anaesthetic agent runs into bottle.
  If anaesthetic agent has also to be removed from the wick, see "Blowing off Vapor" Page 46.

Do not fill bottle to very top. This can lead to significant amounts of anaesthetic agent escaping.

- If necessary, close drainage valve in good time and continue process with new bottle.
- Turn drainage valve clockwise to close.



- Close anaesthetic agent bottle.

Anaesthetic agent may otherwise be released.

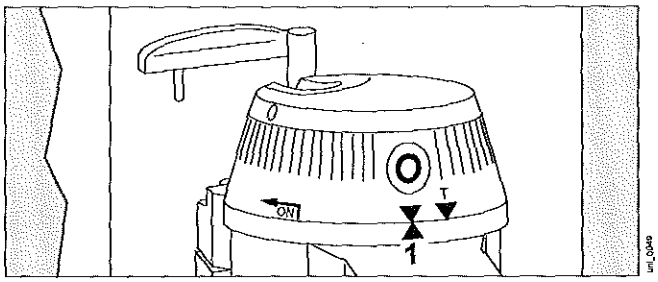
Mark bottle "Used anaesthetic agent".
Recommendation: **Do not re-use.**

Vapor with Quik Fil filling system

Note warnings on page 41.

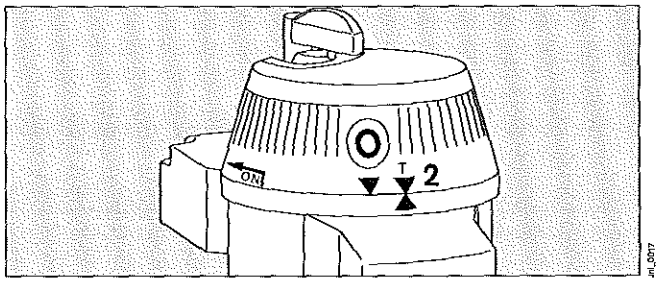
If Vapor is connected to anaesthesia delivery system:

1 Control dial must be engaged at »0«.



If Vapor **is not** connected to anaesthesia delivery system:

2 Control dial remains engaged at »T«.



- Only use undamaged bottles and Quik Fil drain adapter.

Quik Fil drain adapter must be flush and secure on the bottle, as significant quantities of anaesthetic gas may escape otherwise.

- Use correct bottle for **anaesthetic agent concerned.**

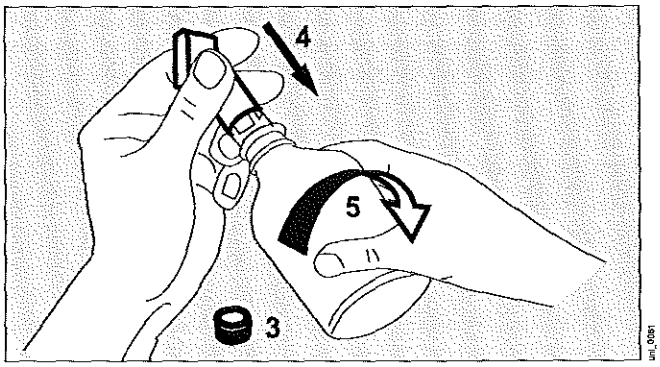
Check that the name of the anaesthetic agent and colour coding on the Vapor and the anaesthetic agent bottle correspond so that dangerous mixtures of anaesthetic agent do not occur.

3 Unscrew cap from bottle adapter.

4 Fit slots on socket of drain adapter onto corresponding ridges on bottle adapter.

5 Push drain adapter against bottle and turn bottle. Screw up tightly.

If bottle is not screwed on tightly, valve in bottle will not open and anaesthetic agent may leak during draining. Danger to health.



1 Push drain adapter into the slot on the filling system **to the stop** and keep holding bottle in this position during draining.

2 As well as setting control dial to »T«, open locking cap on the filling device.

3 Use 2.5 mm Allen key to turn one or two times anti-clockwise *taking care that no anaesthetic agent overflows* from the drain adapter. If necessary, close drainage valve a little.

- Drain until no more anaesthetic agent is visible in sight glass and no more anaesthetic agent runs into bottle.
  If anaesthetic agent has also to be removed from the wick, see "Blowing off Vapor", page 46.

Do not fill bottle to very top. This can lead to significant amounts of anaesthetic agent escaping.

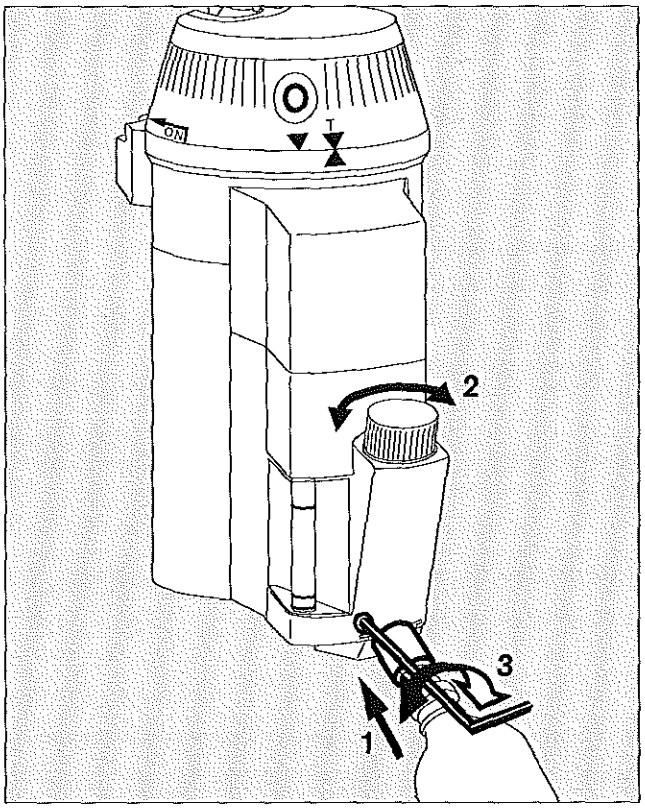
If necessary, close drainage valve in good time and continue process with new bottle.

3 Turn drainage valve clockwise to close.

- Pull out bottle and keep upright.
- Unscrew drain adapter from bottle.
  As bottle valve will not close otherwise and anaesthetic agent may evaporate or run out.

2 Tighten screw cap firmly, otherwise fresh gas and anaesthetic agent may escape.

- Screw cap onto bottle adapter.
- Mark bottle "Used anaesthetic agent".
  Recommendation: **Do not re-use.**

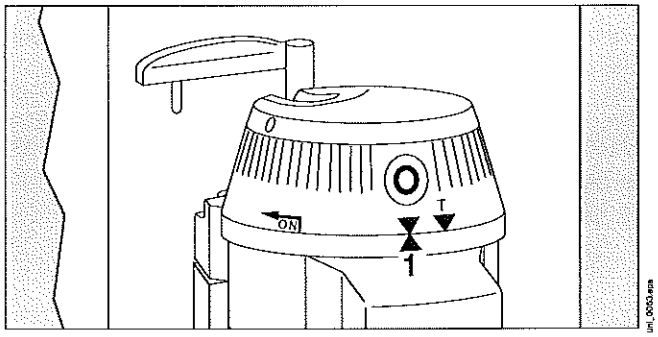


Vapor with filling spout

Note warnings on page 41.

If Vapor is connected to anaesthesia delivery system:

1 Control dial must be engaged at »0«.



If Vapor is **not** connected to anaesthesia delivery system:

2 Control dial remains engaged at »T«.

3 Hold **correct bottle for the anaesthetic agent concerned** below the drainage outlet.

Check that the name of anaesthetic agent and colour coding on the Vapor and the anaesthetic agent bottle correspond so that dangerous mixtures of anaesthetic agent do not occur.

4 As well as setting control dial to »T«, open locking cap on filling device.

5 Turn drainage valve anti-clockwise one or two times.

- Drain until no more anaesthetic agent is visible in sight glass and no more anaesthetic agent runs into bottle. If the anaesthetic agent has also to be removed from the wick see "Blowing off Vapor", page 46.

Do not fill bottle to very top. This can lead to significant amounts of anaesthetic agent escaping.

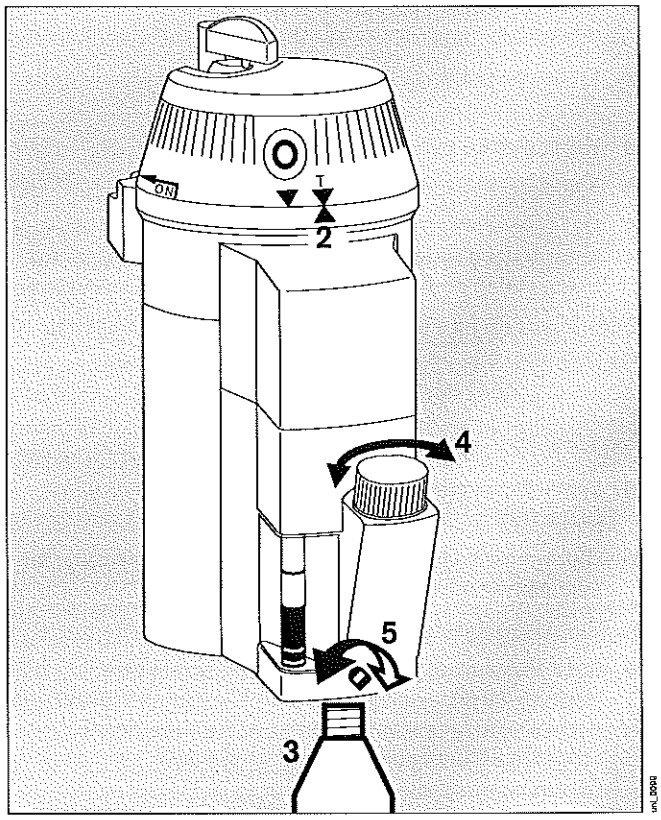
If necessary, close drainage valve in good time and continue process with new bottle.

5 Close drainage valve clockwise.

- Close anaesthetic agent bottle.

4 Tighten screw cap firmly, as fresh gas and anaesthetic agent may escape otherwise.

- Mark bottle "Used anaesthetic agent". Recommendation: **Do not re-use.**



Blowing off Vapor

If anaesthetic agent has also to be removed from the wick after draining:

- Set control dial to 5 vol.% and flush for about 5 hours at 5 L/min Air or 1 hour at 15 L/min Air.
- Allow gas to flow into the scavenging line.
- Press »0«-button, engage control dial at »T«.
  Plug-in adapters: engage locking lever in control dial.

Storage

Storage for longer than 6 months:

- "Draining Vapor", pages 41 to 45 and "Blowing off Vapor", see above.
- Press »0« button and engage control dial at »T«.
  Plug-in adapters: engage locking lever in control dial.
- Vapor may be stored in any position.
- If packing is necessary, see "Despatch".
- **Observe storage temperatures, see page 48. If storage temperature range is exceeded, internal damage may occur which could cause incorrect output concentration.**

Before putting into operation again carry out inspection and service, and test for Readiness for Operation.

Despatch

- **Drain Vapor completely** (page 41), clean and disinfect (page 35).
- Disconnect Vapors from anaesthesia delivery systems for despatch – unless permanently connected.
- Set control dial to »T« and engage.
- Each Vapor must be packed **separately** with care.
  Use original packaging, when possible. If original packing is not available, use strong packing with at least 5 cm of impact-resistant material around each Vapor.
  Fasten packing securely.

Liquid anaesthetic agents and filled Vapors are subject to Hazardous Goods Regulations (under no. UN 8027 in accordance with Class 9 of IATA/ICAO). These regulations do not apply to the residues of anaesthetic agents left in the wick after draining.

Return, disposal

When repair is not economical, DrägerService offer an exchange service for disposing of Vapors.

Before disposal, drain completely (page 41), blow off (page 46), clean and disinfect (page 35).
Worn parts can be disposed of in the normal way.

Maintenance Intervals

Clean and disinfect Vapor before each service[1] **and when returning for repair** (see page 35).

Inspection and service

Yearly, at the same time as the anaesthesia delivery system, to be carried out by trained service personnel, following a protocol.

Recommendation: Call DrägerService for inspection and service.

The Vapor 2000 inspection and maintenance schedule is specified in the "DrägerService Test Certificate for the Vapor 2000". The following wear parts must be replaced if any non-conformities with the specified values are found during maintenance and inspections or during routine checks by the user.

Wear parts

- Gas inlet filter
- Mounting screws
- Seal of keyed filling system (interface to filling adapter)
- Seal of screw cap for Dräger Fill-, Quik Fil and funnel filling systems
- Seal of drainage valve
- Vaporising chamber valve
- Wick of vaporising chamber (only for Halothane)

1 Definitions:
Inspection = determining actual condition
Service = measures to maintain required condition
Repair = measures to re-establish required condition
Maintenance = inspection, service and, when necessary, repair

Technical Data

Classification as per EC Directive 93/42/EEC Annex IX	Class II b
UMDNS-Code Universal Medical Device Nomenclature System – Nomenclature for medical products	10-144
Operating range	
Ambient and Vapor Temperature	
during operation	10 to 40 °C; but Halothane and Isoflurane Vapors may only be operated between 35 and 40 °C if atmospheric pressures is between 850 and 1100 hPa
during shut-down (filled, control dial at »T«)	0 to 40 °C
during storage (empty, dry wick)	–20 to 70 °C
Atmospheric pressure	
during operation and shut-down (filled, control dial at »T«)	700 to 1100 hPa but Halothane and Isoflurane Vapors may only be operated between 35 and 40 °C if atmospheric pressures is between 850 and 1100 hPa
during storage (empty, dry wick)	500 to 1200 hPa
Relative humidity	0 to 95 %
Magnetic induction	<70 Millitesla
Flow range	0.25 to 15 L/min 0.25 to 10 L/min for concentrations >5 vol.%
Direction of flow	as per arrow on back of Vapor (see page 11)
Quality of gases required	Clean, medically pure mixtures of O_2 and Air or O_2 and N_2O O_2 and Air: dewpoint ≤5 °C at 0.5 MPa (5 bar) N_2O: water content ≤2 mg/L at 0.5 MPa (5 bar) AIR: oil content ≤0.5 mg/m^3
Difference between pressure range and ambient pressure on Vapor outlet (e.g. due to machine components or O_2 flush)	–10 to 20 kPa (–100 to 200 mbar)
Alternating pressure due to ventilation on Vapor outlet, relative to pressure on Vapor outlet without ventilation	–1 to 8 kPa (–10 to 80 mbar)
Maximum angle of tilt	
alone, freestanding	10°
during operation, fixed position	30°
during transport (control dial at »T«)	any position and angle

Set values

0 and 0.2 to maximum concentration on control dial scale.
When control dial at »0« and »T« no output of anaesthetic agent.

Accuracy of concentration delivered
(highest value always applies)

	at 15 to 35 °C at 0.25 to 10 L/min	at 10 to 15 °C at 35 to 40 °C at 10 to 15 L/min
Vapors up to 6 vol.% max. concentration	±0.20 vol.% or ±20 % rel.	+0.30 / −0.20 vol.% or +25 / −20 % rel.
Vapors above 6 vol.% concentration	±0.25 vol.% or ±20 % rel.,	+0.35 / −0.25 vol.% or +30 / −20 % rel.

including one of the following conditions (single parameter variation):

- variation of air flow in range given at 22 °C room and Vapor temperature and 1013 hPa or
- variation of temperature in range given at an Air flow of 2.5 L/min and 1013 hPa or
- variation of atmospheric pressure in range given at Air flows of 2.5 L/min Air and 22 °C room and Vapor temperature
- variation of operating time at 22 °C, Air flow of 2.5 L/min and 1013 hPa, provided that Vapor temperature does not deviate from the range given above.

Filling volume for anaesthetic agent

about 360 mL with dry wick
about 300 mL with moist wick
about 260 mL between minimum and maximum mark

Consumption of anaesthetic agent [mL/hour]

~3 x fresh gas flow [L/min] x concentration [vol.%]

Rough formula for running time [hours]
(for 260 mL anaesthetic agent)

$$= \frac{85}{\text{Fresh gas flow [L/min]} \times \text{concentration [vol.\%]}}$$

Example: Fresh gas flow = 2 L/min, concentration = 1.4 vol.%
running time = 30 hours

Loss of anaesthetic agent into atmosphere per 24 hours in mL liquid

	10 °C	22 °C	40 °C
setting »0« (max. 30° tilted)	≤0.3	≤0.5	≤0.7
setting »T« (max. 30° tilted)	≤0.2	≤0.3	≤0.4
setting »T« (horizontal or upside down)	≤0.8	≤1.5	≤2.5

Anaesthetic agent only escapes in very small quantities into Vapor or towards patient.

Flow resistance (without connector)
at 10 L/min Air in mbar (*1 mbar = 100 Pa*)

	10 °C	22 °C	40 °C
Vapor set at »0« or »T«	<40	<35	<30
Vapor switched on	<150	<70	<35

Materials

Vapor 2000 contains no latex.

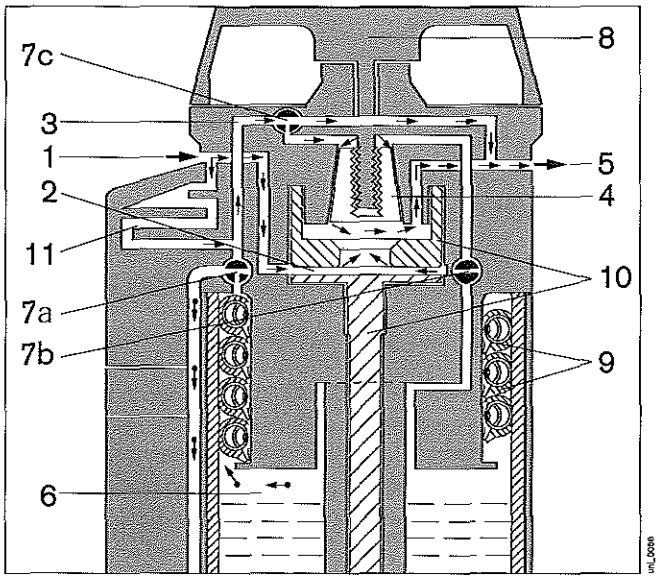
Description

Operating principle

Control dial at »0« (switched off)
Fresh gas (arrow) flows from Vapor inlet **1** to the vaporising chamber-bypass **2** and then passes from the outside to the inside through this gap. In parallel, some of the fresh-gas flows via an additional bypass **3** and flow control cone **4** to Vapor outlet **5**.
The vaporising chamber **6** is completely shut off from the gas flow by valves **7a** and **7b**. No anaesthetic agent can enter the dosing gap and the fresh-gas.

A small bleed hole in valve **7a** connects the vaporising chamber to the atmosphere to prevent any build-up of pressure. Through diffusion and pressure equalisation during temperature and pressure fluctuations small quantities of anaesthetic-agent vapour may escape. This process is hindered by ducts and buffer volumes.

When the Vapor is at an angle anaesthetic agent may leak through the bleed hole in the vaporising chamber.

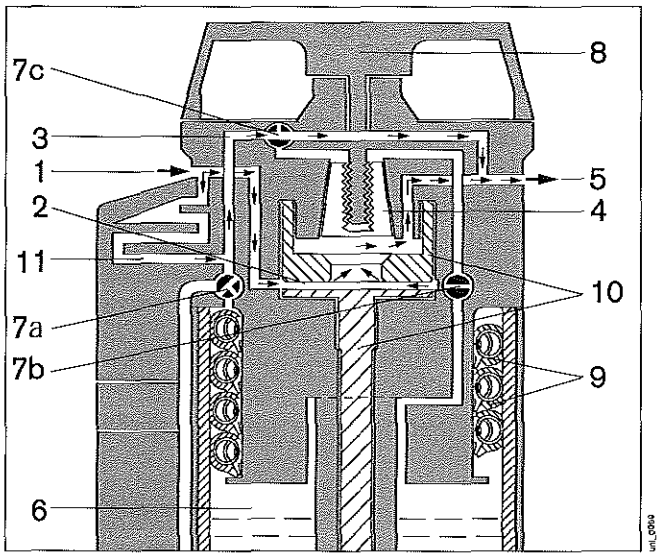


Control dial at »T« (transport)
Fresh gas no longer flows over valve **7c** to the flow control cone **4**. The bleed hole in the vaporising chamber is closed by valve **7a**. No anaesthetic-agent vapour can escape and Vapor is protected against overflowing, even when at an angle. It may be transported in any position.

Closing off the vaporising chamber completely may result in a small positive or negative pressure due to temperature and pressure fluctuations in the room.

Higher pressure is only caused by a rapid rise in temperature and/or falling atmospheric pressure, e.g. during transport in the sun or at high altitudes.

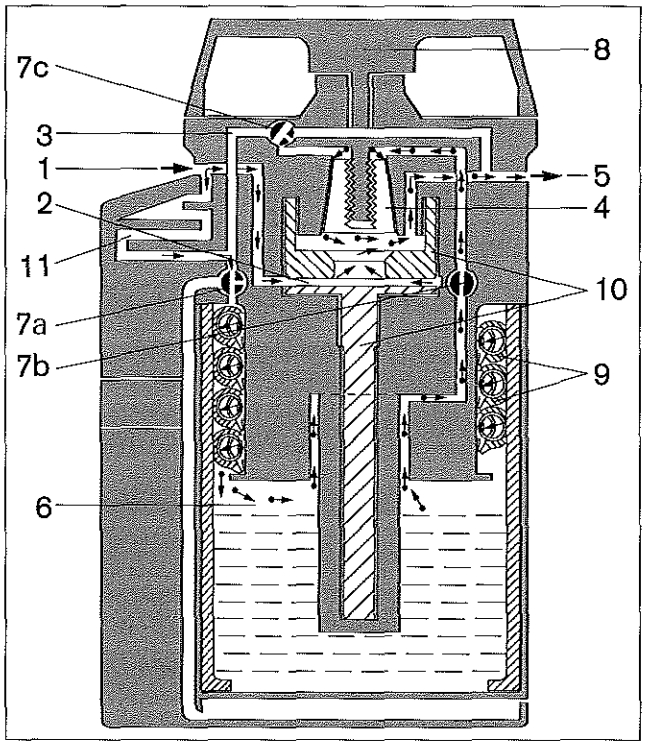
This pressure is adjusted to ambient conditions by setting the control dial to »0« or by opening the filling system. Small quantities of anaesthetic agent may escape during these processes.



Control dial above »ON« (switched on)
Fresh gas (arrow) is routed through valves **7a** and **7b**, linked to the control dial **8** and through the vaporising chamber **6**. Valve **7c** closes off bypass **3**.

Some of the fresh gas is enriched with anaesthetic-agent vapour (arrow with dot) in the saturated wick **9**. The rest of the fresh gas is routed past the vaporising chamber **6** through a bypass **2**.
The two flows are mixed in the space behind the two flow controls and routed to outlet **5**. The concentration is the result of mixing the two gas flows and of the saturation concentration of the anaesthetic agent.
The concentration of anaesthetic agent is also influenced by the temperature compensator **10**, which makes use of the thermal expansion characteristics of two different materials to expand or contract the vaporising chamber bypass **2**, depending on temperature. This process compensates for the influence of temperature on saturation.

The pressure compensating labyrinth **11** effectively reduces any pumping effect caused by pressure fluctuations (see "Influence of fluctuations in pressure", page 58).



Calibration

Every Vapor is individually set at 22 °C and at a continuous air flow of 2.5 L/min without ventilation pressure, and tested at 22 °C and 30 °C as well as 2.5 L/min.

Calibration is in % partial pressure (% of 1013 hPa) as the depth of anaesthesia depends on the patient's uptake which is itself determined by partial pressure.

Concentration delivered in % partial pressure at normal pressure of 1013 hPa is identical numerically with the output given in volume percent, so the marking on the Vapor is given in vol.%.
The output in vol.% must be corrected for other atmospheric pressure values (see "Influence of atmospheric pressure", page 57) but partial pressure always remains constant (see also pages 39 and 56).

For simplicity, settings on the Vapor and in the Instructions for Use are given in the abbreviated form of vol.%, which means vol.% at 1013 hPa and % partial pressure in the abbreviated form.

The scale values on the control dial show the concentration delivered at 22 °C with dry gases (see "Technical Data", page 48).

Influence of temperature

Vapor compensates for changes in temperature. The saturation concentration of the anaesthetic agent, which rises as temperature rises, is automatically balanced by routing a higher proportion of the gas flow through the vaporising chamber-bypass (see page 53).

The linear change of the bypass gap changes the flow through the bypass in a non linear manner which do not match perfectly the non-linear variation of the partial pressure exactly for the full temperature range, so that the concentration delivered still remains slightly dependent on temperature.

The diagrams show typical temperature dependence when operating with a 2.5 L/min flow of Air. The deviations increase for temperatures outside this range, despite continuing compensation.

Under no circumstances must the temperature of the anaesthetic agent reach boiling point, as the output concentration will then become impossible to control.

As altitude increases, boiling point falls:

Atmospheric Pressure/ Altitude	Boiling point of anaesthetic agent °C			
	1013 hPa 0 m	900 hPa 1000 m	800 hPa 2000 m	700 hPa 3000 m
Halothane	50.2	46.8	43.4	39.8
Enflurane	56.5	53.4	50.3	46.8
Isoflurane	48.5	45.4	42.2	38.9
Sevoflurane	58.6	53.4	52.1	48.7

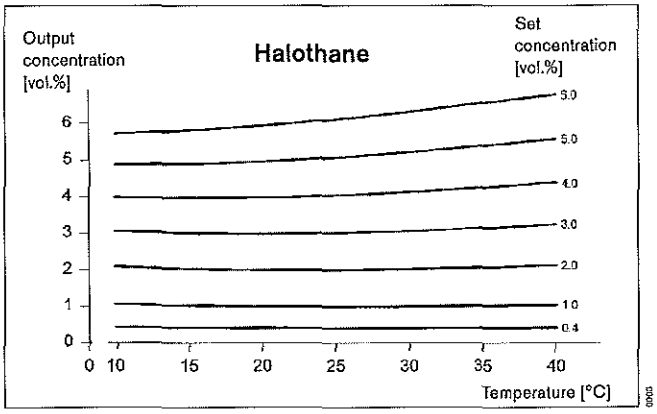
= non-permissible operating ranges.

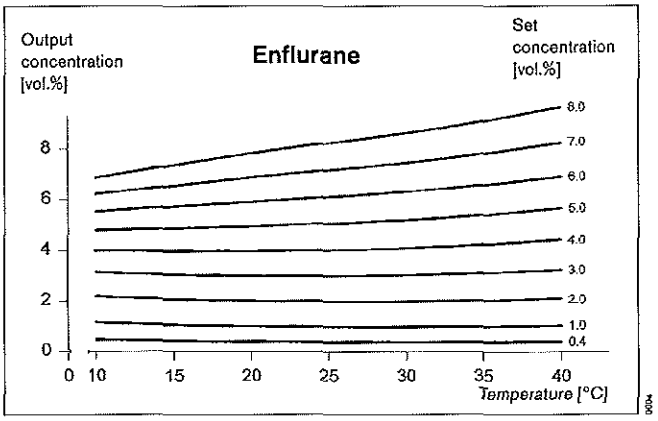
The operating range for Vapor when used with Dräger anaesthesia delivery systems has been set in such a way that, in the critical situation of 700 hPa, 40 °C (or 850 hPa for Halothane or Isoflurane Vapors) and a maximum negative pressure of –100 mbar on the Vapor, the boiling point of the anaesthetic agent cannot be reached.

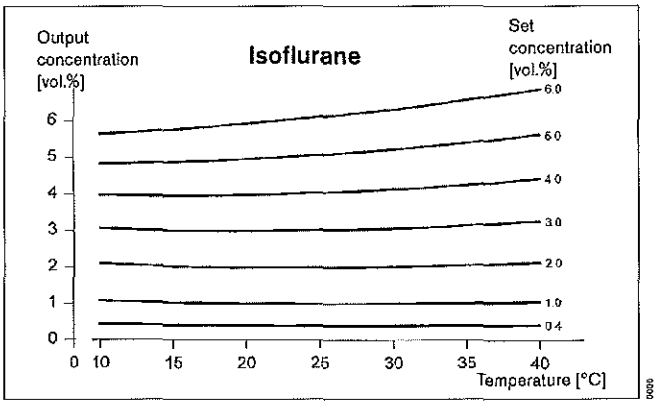
The extension of temperature compensation is independent of ageing and hysteresis and Vapor's large mass also provides some compensation for differences in temperature.

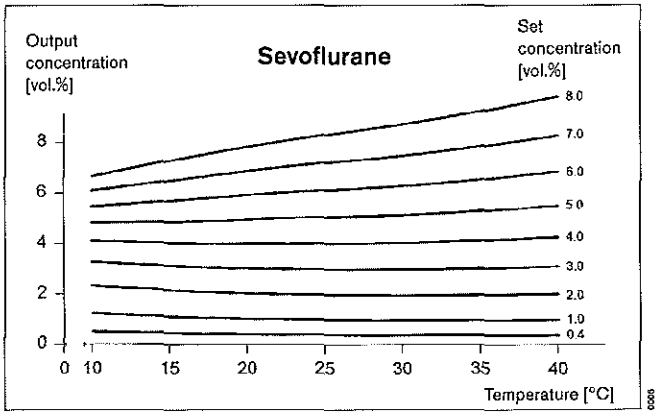
Differences in temperature between Vapor and the atmosphere within the operating range are compensated for within the concentration accuracy specified. If the temperature of the Vapor before use is outside 10 to 40 °C, a time of 15 min/ °C has to be allowed for temperature adjustment, if the concentration is to remain within the accuracy specified.

When Vapor is being operated with a high gas flow or a high concentration, it cools through evaporation (see "Influence of running time", page 59).







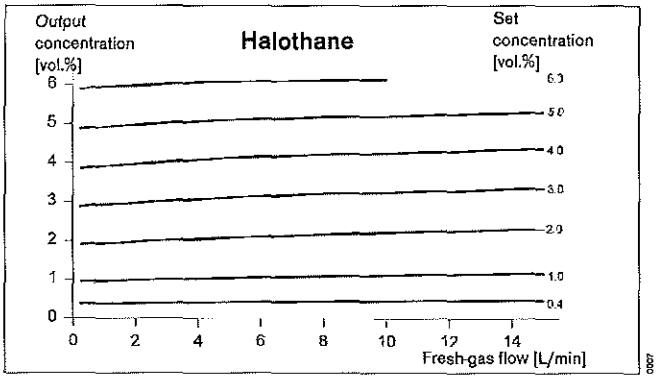


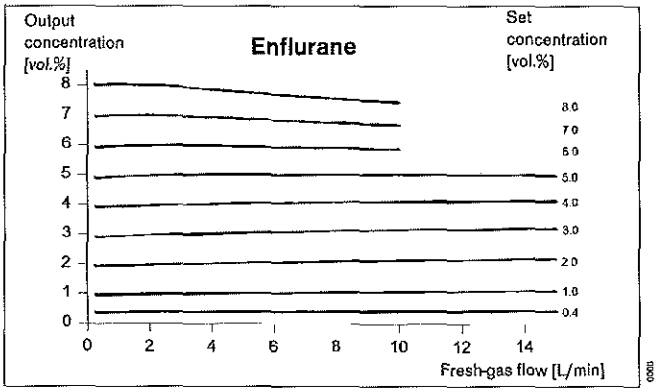
Influence of flow

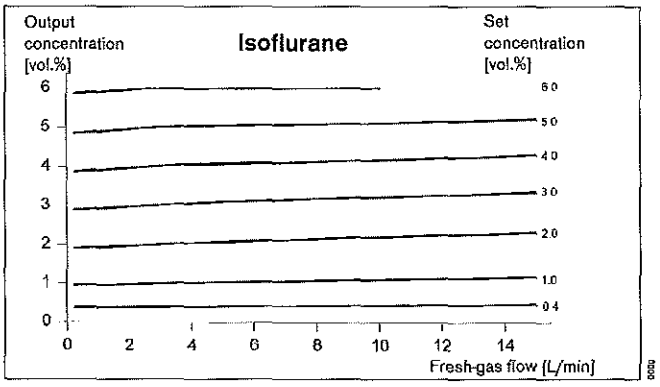
Within the specified flow range, the concentration delivered by Vapor is only slightly dependent on the fresh-gas flow.

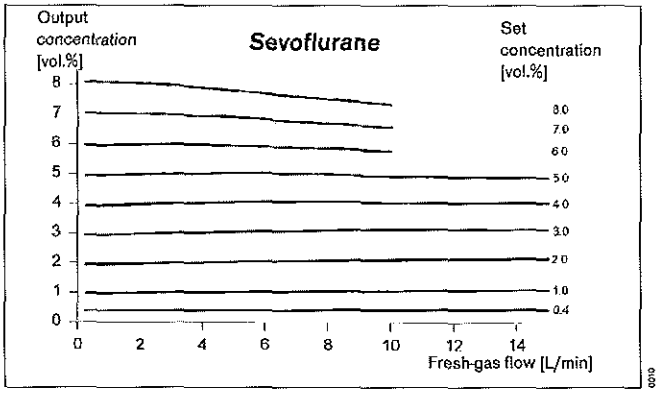
The output concentration is reduced slightly when high concentrations are set at the same time as a high fresh- gas flow. Under such conditions total saturation of the gas flowing through the vaporising chamber does not occur and also full compensation is not made for the cooling of the anaesthetic agent due to evaporation (see "Influence of running time", page 59).

The diagrams show the typical influence of flow on the concentration delivered after 1 minute at 22 °C, 1013 hPa when operating with Air.









Influence of gas composition

The concentration delivered is dependent on the composition of the fresh gas since the viscosity and density of the gas changes from one gas to another. Vapor is calibrated with Air because the concentration delivered is then exactly in the middle of the range for the anaesthetic gas mixtures which are available.

When 100 % O_2 is used the output concentration compared with Air rises by 10 % of the set value and by not more than 0.5 vol.%.
When a mixture of 30 % O_2 and 70 % N_2O is used, the concentration falls by 10 % of the set value at most, and by not more than 0.5 vol.%.

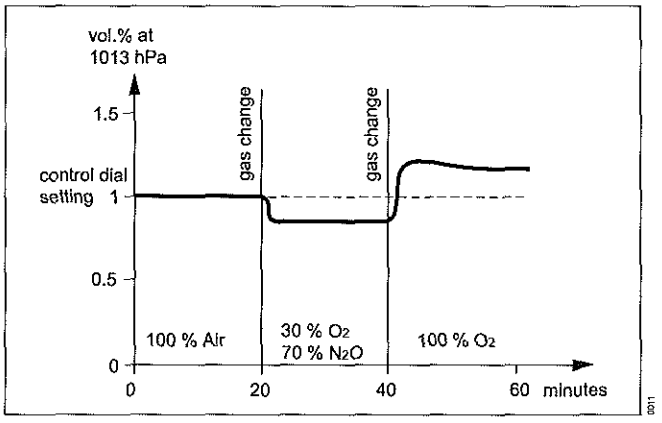
The effect of gas composition is different for different anaesthetic agents and, for this reason, maximum effects are given here.

When changing from one gas mixture to another, an additional dynamic effect can occur which may result in a further deviation in concentration until any earlier fresh gas is flushed out of the vaporising chamber.

These deviations and their duration will all be greater,
- the lower the volume of anaesthetic agent in the Vapor,
- the lower the concentration set
- the lower the gas flow and
- the more extreme the change of gas type.

The extent of this dynamic deviation increases as gas flow increases, though the duration of the deviation will decrease. The duration with, e.g. 1 L/min, 1 vol.% and slightly filled Vapor is up to 30 minutes.

Influence of gas composition on output concentration in carrier gas at 1 vol.% setting.



If the humidity in a gas is higher than that specified in "Technical Data" output concentration will be affected slightly.

Influence of atmospheric pressure

The anaesthetic agent partial pressure delivered by Vapor (see "Calibration", page 53) is all but independent of atmospheric pressure, so that weather-based fluctuations do not need to be taken into account and altitude-based pressure changes in the range 700 to 1100 hPa will only lead to small deviations within the accuracy specified. For this reason, the physiological effect – the depth of anaesthesia at a defined Vapor setting – is independent of atmospheric pressure.

When measuring the output concentration of Vapor in partial pressure (e.g. with Dräger IRIS or PM 8030/35) there is no influence from ambient pressure. When measuring in volume percent (e.g. Dräger PM 8020 or PM 8050) the measured values do, however, change with atmospheric pressure and measured values rise, when atmospheric pressure falls below 1013 hPa.

The following formula for conversion applies:

$$\text{Concentration [\% partial pressure]} = \frac{\textit{Measured value [vol.\%]} \times \textit{Atmospheric pressure [hPa]}}{1013\ \text{hPa}}$$

Example:

At 4 % partial pressure at an altitude of 1000 m and at 900 hPa, 4.5 vol.% is displayed, and 5.1 vol.% at an altitude of 2000 m at 795 hPa.

Under no circumstances should Vapor ever be used at atmospheric pressures and temperatures at which the anaesthetic agent could start to boil (see page 54), as the concentration delivered will rise and be uncontrolled.

Influence of positive/negative pressure

relative to ambient and dynamic pressure

Vapor's operating range is limited to between –100 and 200 mbar, relative to ambient atmospheric pressure at the Vapor outlet.
Pressure in the Vapor is a little higher than ambient atmospheric pressure, as the fresh-gas flow builds up a *dynamic pressure of up to 115 mbar in the flow control system.* Vapor cannot distinguish between a constant dynamic pressure and an ambient pressure influenced by altitude. For this reason, the influence on output concentration is in accordance with the data given above under "Influence of atmospheric pressure".
For effective O_2 flushing on Dräger anaesthesia delivery systems a negative pressure is produced at the Vapor outlet which may be up to 100 mbar. 100 mbar negative pressure has the same effect as raising the altitude by 1000 m or a drop in boiling point of about 3.5 °C (see page 54). As a protection against excessive pressure, e.g. if the fresh-gas hose is kinked, the Vapor has a self-resetting pressure relief mechanism which vents the fresh gas to the atmosphere at high pressures.

Influence of fluctuations in pressure

during ventilation

When ventilation is being carried out or when the O_2 flush is operated without fresh-gas de-coupling, pressure fluctuations on the anaesthetic vaporiser can cause a higher concentration to be delivered than is shown on the control dial setting.

The vapour in the vaporising chamber is compressed when pressure rises, and it expands when pressure falls. If this effect is strong enough small quantities of saturated vapour will be pumped backwards through the inlet of the vaporising chamber into the fresh gas.
This is described in the literature as the pumping effect.
This pumping effect is greater,

- the higher the ventilation pressure and ventilation frequency,
- the more rapid the fall in pressure during expiration,
- the lower the fresh-gas flow,
- the lower the concentration set,
- the smaller the quantity of anaesthetic agent in the vaporiser.

The compensation system of the Vapor will reduce these effects.

When using anaesthesia delivery systems without fresh gas de-coupling and with ventilation pressures greater than 30 mbar, Vapor should be filled completely, if concentration set is <1 vol.% and/or fresh-gas flow is <1 L/min, to keep deviations due to fluctuations in pressure as low as possible.

Continuous monitoring of the inspiratory side of the breathing system will easily show when an overdosage is likely to occur. The concentration set on the Vapor can then be slightly reduced.

Influence of running time

Evaporation of the anaesthetic agent during operation cools Vapor slowly.
The saturation concentration of the anaesthetic agent in Vapor *decreases more rapidly the longer the duration of operation*, the higher the concentration set and the higher the fresh-gas flow selected, i.e. when more anaesthetic agent evaporates with time.
Temperature compensation counters this effectively and limits deviations in the concentration delivered. After a certain period of operation Vapor stabilises at a slightly lower temperature and an output concentration which is a slight deviation from the initial value.
The accuracy given in "Technical Data", page 48, applies as long as the temperature of the Vapor does not fall below the lower limit of the operating range.

The diagrams show typical concentration curves over 4 hours and 6 hours of running time respectively, measured at 22 °C and 1013 hPa.

The numbers on the curves refer to the operating conditions used:

1 6 or 8 vol.% at 1 L/min

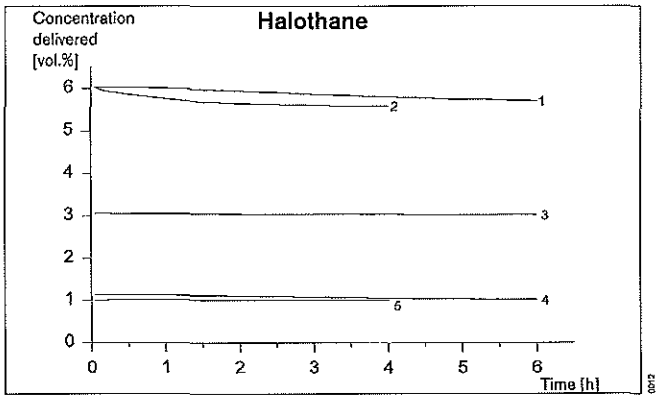
2 6 or 8 vol.% at 4 L/min

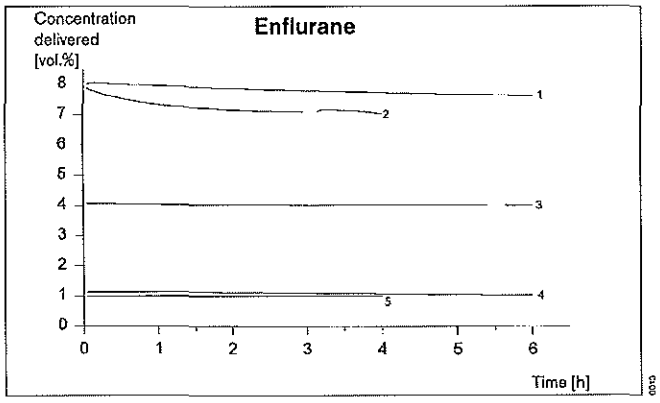
3 3 or 4 vol.% at 4 L/min

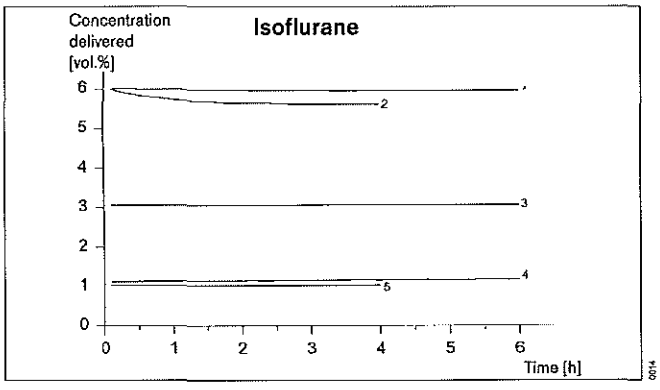
4 1 vol.% at 10 L/min

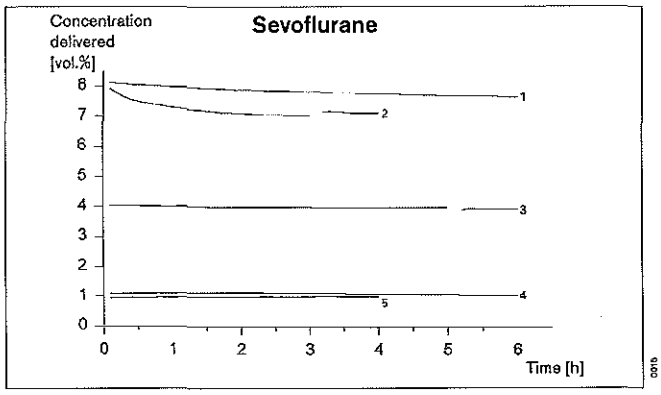
5 1 vol.% at 4 L/min

Breaks in the curves show pauses whilst the anaesthetic agent was being refilled.









Order List

Name and description		Order no.
Filling adapter s for Sevoflurane		M 35 322
Filling adapter i for Isoflurane		M 35 323
Filling adapter e Enflurane		M 35 321
Filling adapter h Halothane		M 35 320
Dräger Fill filling adapter for:		
Halothane		M 36 090
Isoflurane		M 36 110
Sevoflurane		M 36 120
Ball-check valve modification set (for older Dräger filling adapter)		M 34 614
Quik Fil drain adapter		M 34 206
Parking holder for wall rail for 2 Vapors with plug-in adapters		M 26 966
Parking holder for wall mounting for 2 Vapors with plug-in adapters		M 26 374
Instructions for Use	German	DB 01 188
	English	DB 01 189
	French	DB 01 190
	Spanish	DB 01 191
	Italian	DB 01 260
	Dutch	DB 01 261
	Swedish	DB 01 262
	Finnish	DB 01 263
	US English	DB 01 273
	Russian	DB 01 351
	Portuguese	DB 01 352
	Japanese	DB 01 353
	Chinese	DB 01 354
	Norwegian	DB 01 355
	Hungarian	DB 01 356
	Polish	DB 01 357
	Czech	DB 01 358
	Danish	DB 01 359
	Slovak	DB 01 362
	Turkish	DB 01 363
Technical documentation available on request		

Abbreviations and Symbols

Air	Medical Air
N_2O	Medical Nitrous Oxide
O_2	Medical Oxygen
CE0123	Conformité Européenne. Vapor 2000 conforms to 93/42/EEC Medical Device Directive
®	Registered trademark
™	Trademark, protected trademark
% rel.	Relative deviation as % of value
⚠	Observe Instructions for Use
ON	Vapor switched on. Operation between »0« setting and this mark is not allowed, as Vapor has not been calibrated for this range
0,2; 0,4;.....	Concentration scale on Vapor control dial with values up to and including 5 vol.%
❻ ❼ ❽	Concentration values on the Vapor control dial drawing attention to the danger of a high output concentration and restricted flow range
vol.%	Volume percent anaesthetic agent in fresh gas at Vapor outlet. Unit of concentration, see "Calibration", page 53.
0	on push-button to stop control dial. »0« setting on control dial, see page 5
T	Transport setting (»T« setting) on control dial, see page 6
←	on back of Vapor or on connector indicates direction of flow of Vapor
H, E, I, S	on control dial or on DW-2000 plug-in adapter. Code letter for anaesthetic agent for which Vapor 2000 has been calibrated, or for which plug-in adapter is coded.
min.	minimum permissible filling level on sight glass
max.	maximum permissible filling level on sight glass
ASTM	American Society for Testing and Materials
CSA	Canadian Standards Organisation
DGHM	German Society for Hygiene and Microbiology
EN	European standard
ISO	International Organization for Standardization

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Quality Inspection Certificate

(Do not remove. Photocopy if necessary.)

Dräger Medical AG & Co. KG
Moislinger Allee 53-55
D-23542 Lübeck

is certified as a manufacturer of medical products according to Annex II to Directive 93/42/EEC, ISO 9001: 2000.

We hereby confirm to our client
(to be completed by the Dräger Medical AG & Co. KG marketing partner)

.....
.....
.....
.....
.....

that the product

Vapor 2000 **with Serial no. .....**

has been inspected and complies with the technical specifications.

Vapor units bearing the CE mark fulfil the requirements of Annex I to Directive 93/42/EEC (Medical Products).

Dräger Medical AG & Co. KG
Anaesthesia Division
Vapor Production – Final Inspection

These Instructions for Use apply only to
Vapor 2000
with Serial No.:

If no Serial No. has been filled in by Dräger these Instructions for Use are provided for general information only and are not intended for use with any specific machine or device.

CE 0123
Directive 93/42/EEC
concerning Medical Devices

The CE symbol in these Instructions for Use applies only in connection with the CE symbol on the machine!

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